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ABSTRACT

This guide was developed for use by individuals with little or no botanical training who wish to identify native ferns of New York, New England, New Jersey, and Pennsylvania. A random access key, developed by the author, provides multiple pathways for identification of 60 species in 29 genera of ferns. (CS)

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Field Guide to Northeastern

FERNS

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EUGENE C. OGDEN

New York State Museum

Illustrated by Anne E. Lacy and Kathryn M. Conway

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CONTENTS

Page

Foreword v

Acknowledgments vi

Introduction 1

Ferns without fernlike dissected fronds 3

Random access key to species with dissected fronds 5

Keys to groups of species with dissected fronds 19

Keys to species when genus is known 35

Descriptions of species 38

Glossary 115

Index 117

FOREWORD

THE AUTHOR of this publication was a pioneer in the development of the type of key (random access) used in this publication. It is his view that identification of plants in the field should not require that all parts of the plant be present. Since the fronds of ferns do not produce spores throughout the year, keys which depend heavily on "fruiting" characteristics are often useless. The users of this guide will find it to their advantage that there are more keys than species, for when one identification route is not successful another may be tried, almost insuring success. The keys in this book have been tested by groups in the field, amateur and professional alike, and by the author and his son on a home computer. This publication has been five years in the making, but we feel it was well worth the effort. We at the New York State Museum are proud to present such a carefully prepared and beautifully illustrated volume.

Richard S. Mitchell
State Botanist
New York State Museum

ABOUT THE AUTHOR

Dr. Eugene C. Ogden is a native of Michigan. He received his Ph.D. at Harvard University and taught at the University of Maine before coming to the New York State Museum, where he served as State Botanist until retirement in 1975. He was probably the first to use random access keys in 1953; these are very popular in numerical taxonomy today. He is known worldwide as an authority on dispersal of airborne pollen and as a taxonomist of pondweeds (*Potamogeton*).

ACKNOWLEDGMENTS

Among the many persons who have given much appreciated help, several should receive special mention: Richard S. Mitchell, State Botanist of New York, gave continuous encouragement and advice and checked all of the illustrations for accuracy. Charles Sheviak, Curator of the New York State Herbarium, supplied specimens for study and illustration. J. Kenneth Dean offered many valuable suggestions. John T. Mickel, Senior Curator of Ferns at the New York Botanical Garden, reviewed the manuscript and suggested several changes and improvements. Warren H. Wagner, Professor of Botany at the University of Michigan, critically checked the plates of illustrations before the final inking and supplied material of several rare or difficult species. Anne E. Lacy, professional artist, prepared the 60 plates and the cover from living and/or herbarium material and from projected slides. Kathryn M. Conway, staff illustrator, prepared all of the other illustrations. My wife, Edith, author of "The Ferns of Maine," was always available as a consultant on technical characters. My son, Everett, an electronic engineer, fed fern data into his computer, helped prepare the random access key, and sorted the data for the keys to groups of species.

INTRODUCTION

This guide for the identification of the native ferns of New York, New England, New Jersey, and Pennsylvania is prepared primarily for those with little or no botanical training. It is designed especially for field use with fresh specimens. Most of the characters referred to are easily seen, at least with the aid of a ten-power lens and a razor blade or sharp knife (a mini-knife with replaceable blades is excellent). Of course, if only sterile fronds (leaves) are available, the "fruiting" characters (from sori) cannot be determined. Even with fertile fronds, it is sometimes difficult or impossible to be sure of the type of indusium. Fortunately, the characters exhibited by the vascular bundles in the stipes are nearly always easily seen with fresh specimens. For this reason, they are here emphasized more than in most fern identification manuals. They are groups of specialized cells that in cross section (transverse cut) appear much different from the surrounding tissue. Do not confuse with cavities that may be present. Unfortunately these valuable characters can seldom be determined from dried material.

It would be helpful if collectors of ferns for permanent inclusion in a herbarium would indicate on the label or elsewhere the number and shapes of these bundles as seen in cross section of the stipe near its base and also near the blade. Better yet, a small diagram would also show positions and sizes.

This treatment is conservative, serving to identify generally accepted species. It is not meant to supplant more technical manuals which may profitably be used in conjunction with this bulletin. Although several families of ferns are included here, there is no attempt to indicate this. The purpose is identification, not classification. The species descriptions are listed in alphabetical order for ease of locating, rather than being placed in an order that would show their kinship to each other.

As treated here, 70 species in 29 genera have been reported for our area. Sixty of these are described and illustrated. The other ten, being very rare or perhaps extinct (or very similar to other closely related species) are mentioned and contrasted under the species they most closely resemble. Some taxa below the rank of species (subspecies, varieties, forms) are mentioned but not in detail. Hybrids are mentioned briefly, if at all; those commonly treated as species in recent manuals are cited as synonyms under one or both parents. Those interested may consult numerous publications where some disagreement will be found. The differences in names and classifications are primarily because of dates of publication, and thus variations in available knowledge about recent critical studies (cytologic, genetic, etc.). This is especially noticeable in the genus *Dryopteris*. The species descriptions indicate the appearance of the plants and the usual range of variation but not those forms that might be termed abnormalities. The illustrations attempt to indicate characters that are not as easily described in words.

The scientific names (which are international names) are composed of genus (noun) and epithet (modifier). When infraspecific categories are recognized, those terms are part of the scientific name. Sometimes, following the scientific name, may be found the name of the person or persons who authored the taxon. This author citation is not a part of the scientific name and may be used or not as one wishes. It is for bibliographic purposes and relates to the scientific name as does the name of the author of a book to the book's title. The complete author citation would include also the name, date, and page of the original publication.

The common names are those frequently used in our area and in floristic manuals. They can be very useful in local areas but sometimes may be confusing as several names may refer to the same plant and, worse, the same name may apply to different species.

Several publications that include our area, in whole or in part, are very useful, especially for the identification of ferns but in many other ways as well. They include:

Blaustein, Elliott H. 1979. Name that Fern. Saffyre Publications.

Brooks, Karl L. 1979. A Catskill Flora and Economic Botany. I. Pteridophyta. The ferns and fern allies. New York State Museum Bulletin No. 438.

Canan, Elsie D. 1946. A Key to the Ferns of Pennsylvania. Science Press Printing Company.

Chrysler, Mintin A. and J. L. Edwards. 1947. The Ferns of New Jersey, Including the Fern Allies. Rutgers University Press.

Cobb, Boughton. 1956. A Field Guide to the Ferns. Houghton Mifflin Company.

Fernald, Merritt L. 1950. Gray's Manual of Botany. American Book Company.

Mickel, John T. 1979. How to Know the Ferns and Fern Allies. Wm. C. Brown, Publisher.

Morton, Conrad V. in Henry A. Gleason. 1952. The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada. Volume I. New York Botanical Garden.

Ogden, Edith B. 1948. The Ferns of Maine. The Maine Bulletin. University Press, Orono, Maine. Reprinted by Thorndike Press, Thorndike, Maine and University of Maine at Orono Press.

Scamman, Edith. 1947. Ferns and Fern Allies of New Hampshire. New Hampshire Academy of Science, Durham, N. H.

Seymour, Frank C. 1969. The Flora of New England. Charles E. Tuttle Company.

Small, John K. 1935. Ferns of the Vicinity of New York. Science Press Printing Company.

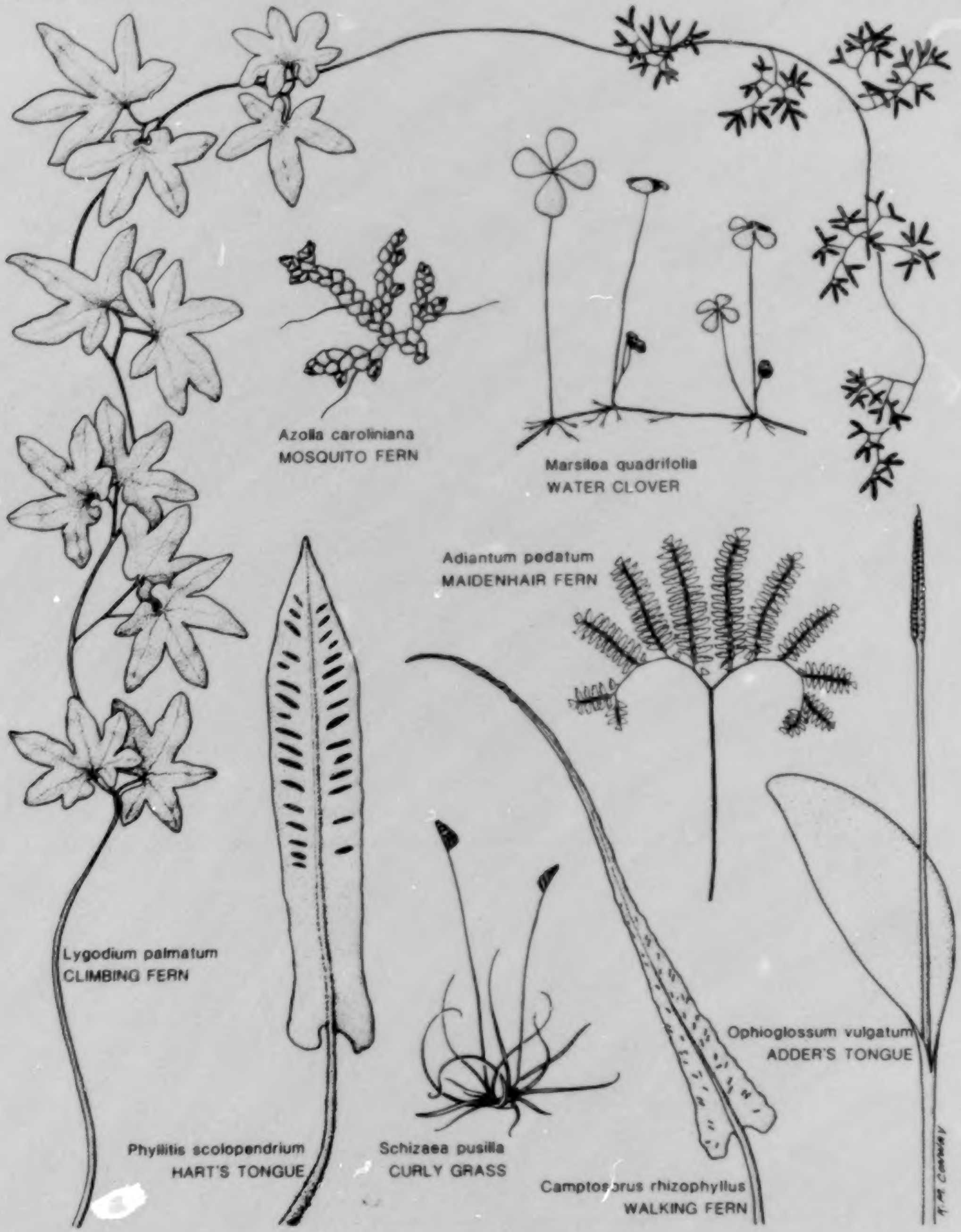
Wherry, Edgar T. 1961. The Fern Guide. Doubleday and Company. Photocopy by The Morris Arboretum of the University of Pennsylvania.

Wiley, Farida A. 1948. Ferns of Northeastern United States. The American Museum of Natural History of New York City.

If in one or more of these publications a species is called by a different scientific name than the one used here, that name is given as a synonym without author citation. It may or may not be a full synonym according to the original author but is a synonym, at least in part, in one or more of the books suggested as being especially useful for our area. For example: *Polypodium vulgare* Linnaeus is not a synonym of *Polypodium virginianum* Linnaeus, but it is a synonym as found in some floras that include the northeastern United States.

FERNS WITHOUT FERNLIKE DISSECTED FRONDS

Eight genera of ferns in our area, each with a single species, lack the pinnately dissected fronds usually associated with ferns. They are here illustrated sufficiently for recognition and are excluded from the keys to ferns with dissected blades. Descriptions are found in alphabetical order with the other ferns. These genera are: *Adiantum*, *Azolla*, *Camptosorus*, *Lygodium*, *Marsilea*, *Ophioglossum*, *Phyllitis*, and *Schizaea*.


Azolla caroliniana
MOSQUITO FERN
Marsilea quadrifolia
WATER CLOVER
Adiantum pedatum
MAIDENHAIR FERN
Lygodium palmatum
CLIMBING FERN
Ophioglossum vulgatum
ADDER'S TONGUE
Phyllitis scolopendrium
HART'S TONGUE
Schizaea pusilla
CURLY GRASS
Camptosorus rhizophyllus
WALKING FERN

RANDOM ACCESS KEY TO SPECIES WITH DISSECTED FRONDS

This key differs from the usual keys found in floristic manuals, for here the user makes all of the choices in any order, being influenced by which characters are most easily determined, rather than in the order chosen by the author of the key. It uses a list of numbers, one through 52, representing the 52 species in the key. For this, the pages of numbers that are supplied in the back of the bulletin (or photocopies of them) may be employed.

The eight species illustrated under FERNS WITHOUT FERNLIKE DISSECTED FRONDS (Page 3) are not included in this key.

Choose any character among the 93 listed that agrees with the material at hand and delete the numbers that follow the chosen statement. Continue in this way with any other characters, in any order, until only one number is left or no further characters are exhibited by the plant material. Reference to the numbered list (page 18) will indicate the possibilities.

For example: if "leafy blades pinnatifid" is chosen, only the numbers 15, 31, 33, and 41 remain. If we now choose "veins not reticulate and mostly forked two or more times," we delete 31 and 33, leaving 15 and 41. We might now choose "leafy blades 20-50 cm long" which eliminates 15, leaving only 41. The numbered list of species indicates that the specimen is *Polypodium virginianum*. Comparison with the description (text and illustrations) should indicate if the correct identification has been made.

An alternate procedure (which does not require a sheet of numbers but merely a bit of scrap paper) is: first choose a statement that agrees, write down only the numbers that do not appear (and thus remain as possibilities), then continue in the usual way.

The numbers following the statements are those of the species that *do not* agree. This has been found to increase both accuracy and speed. In seeking the identity of a specimen, all keys proceed to this end by eliminating those that do not agree with the characters exhibited by the specimen.

When complete parts with recognizable characters are available, this key should proceed smoothly to one species. Even when some parts are missing or unclear, it may eliminate all but a few in one genus. The KEYS TO SPECIES WHEN GENUS IS KNOWN will help to make the final determinations. If, after the available characters are used, species in more than one genus remain, reference to the DESCRIPTIONS OF SPECIES should help. These are listed in alphabetical order by genus and species.

Field use of this key has indicated that among the better characters for early use are: dissection of leafy blades and bundles at base of stipe. However, if some characteristic of the specimen appears to be outstanding, it should be chosen early. If the specimen appears to be *very* small or *very* large, then size of frond might eliminate many species. Other useful characters to be used early are stipe length when *much* shorter or *much* longer than blade, basal pinnae when *much* shorter or *much* longer than middle pinnae, type of dimorphism, and type of indusium. Experience in keying out a few specimens will soon indicate the procedures that work well for you.

FRONDS

Dimorphism

Fertile and sterile blades similar in shape: not 9-16, 18, 31-36.

Fertile and sterile blades separate and much different but on a common stipe: not 1-8, 17-52 *(leaving only 9-16).*

Fertile and sterile blades much different but on separate stipes: not 1-17, 19-30, 35, 36, 38-41, 43-45, 47-52 *(leaving only 18, 31-34, 37, 42, and 46).*

Fertile pinnae much different in shape from sterile pinnae but on the same blade: not 1-34, 37-41, 43-52 *(leaving only 35, 36, and 42).*

Fertile pinnae slightly different in shape from sterile pinnae and on the same blade: not 1, 3-6, 9-36, 38-41, 43-52 *(leaving only 2, 7, 8, 37, and 42).*

Length (mature leafy blade and stipe)

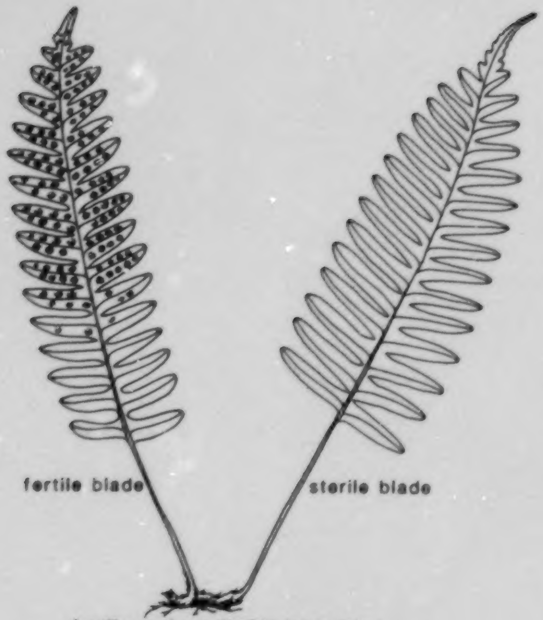
Less than 10 cm long: not 7, 8, 16, 17, 19-24, 26-29, 31-36, 40, 42-47, 51, 52.
10-30 cm long: not 7, 8, 19, 22, 26, 31-36, 40, 47, 52.
30-100 cm long: not 1, 3-5, 11, 15, 17, 18, 41, 48-50.
More than 100 cm long: not 1-6, 9-18, 20, 22, 25, 27, 30, 31, 37-41, 43, 45, 47-51.

Width (mature leafy blade at widest part)

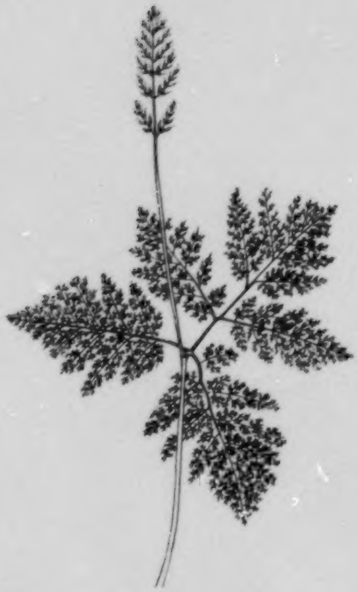
Less than 6 cm wide: not 6-8, 19, 21-24, 26-36, 40, 43-47, 52.
6-20 cm wide: not 3-5, 10-12, 15, 18, 25, 26, 41, 48-50.
20-30 cm wide: not 1-5, 9-12, 15, 17-20, 24, 25, 31, 37, 38, 41-43, 45-51.
More than 30 cm wide: not 1-5, 7-15, 17-21, 23-25, 27-31, 34, 35, 37-39, 41-43, 45-52 *(leaving only 6, 16, 22, 26, 32, 33, 36, 40, and 44).*

Persistence

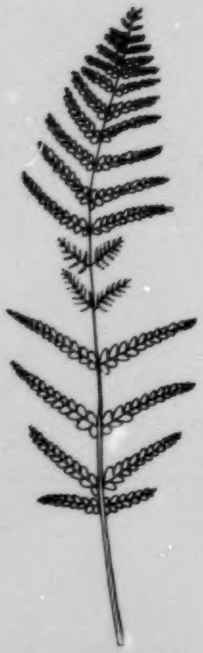
Evergreen: not 6-8, 10-12, 15, 16, 19-22, 30-36, 39, 40, 44-50, 52.
Deciduous: not 1-4, 9, 13, 14, 17, 25, 27, 28, 37, 38, 41, 42.



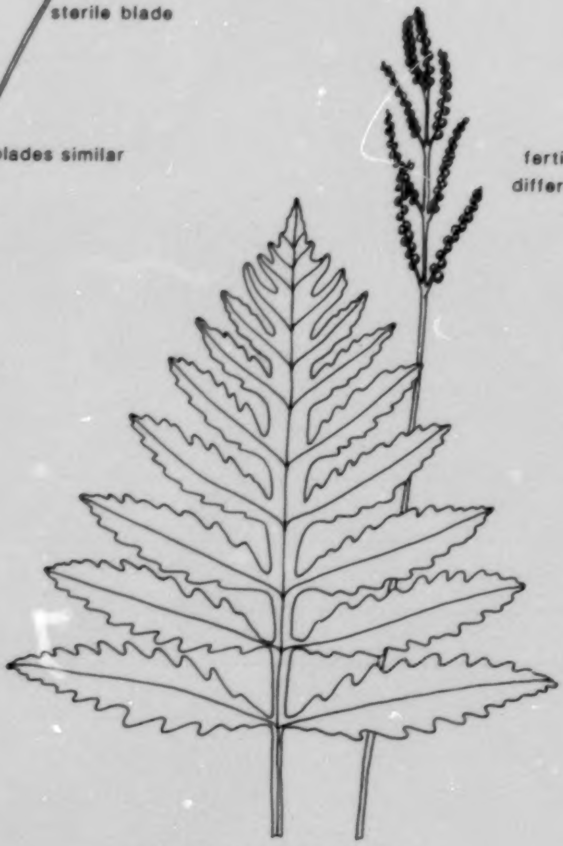
fertile and sterile blades similar



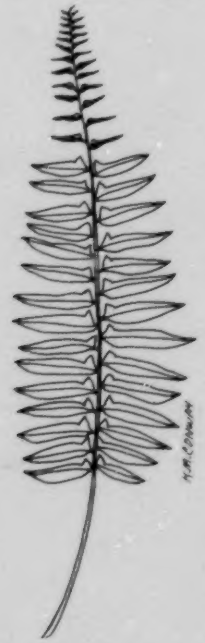
fertile and sterile blades much different but on a common stipe



fertile and sterile pinnae much different but on the same blade



fertile and sterile blades much different but on separate stipes



fertile and sterile pinnae slightly different but on the same blade

LEAFY BLADES

Dissection (lower part of blade)

Ternate: not 1-8, 11, 12, 17-29, 31-43, 45-52 *(leaving only 9, 10, 13-16, 30, and 44).*

Pinnatifid: not 1-14, 16-30, 32, 34-40, 42-52 *(leaving only 15, 31, 33, and 41).*

Once pinnate: not 1, 3, 6, 8-10, 13, 14, 16-30, 32, 34-36, 39, 40, 43-52.

Pinnate-pinnatifid: not 2-7, 11, 13-17, 21, 22, 27, 29-31, 36-38, 43, 44.

Bipinnate: not 2, 4, 5, 7, 11, 16, 27, 30-33, 39, 41, 42, 44, 48, 49.

Bipinnate-pinnatifid: not 2, 4, 5, 7, 8, 10-12, 15, 24, 31-39, 41-43, 45-50, 52.

Tripinnate: not 1-5, 7, 8, 10-12, 15, 19, 21, 23-26, 28, 31-43, 45-52.

Tripinnate-pinnatifid: not 1-8, 10-12, 15-17, 19-29, 31-43, 45-52 *(leaving only 9, 13, 14, 18, 30, and 44).*

Quadripinnate: not 1-8, 10-12, 14-17, 19-52 *(leaving only 9, 13, and 18).*

Length (mature blade)

Less than 4 cm long: not 1, 2, 4, 6-8, 14, 16, 17, 19-47, 49-52 *(leaving only 3, 5, 9-13, 15, 18, and 48).*

4-10 cm long: not 7, 8, 19, 21-24, 26-29, 31, 32, 34-36, 40, 42-45, 47, 51, 52.

10-20 cm long: not 7, 8, 10-12, 14, 15, 19, 22, 23, 26-28, 34-36, 43, 45, 49, 52.

20-50 cm long: not 1, 3, 5, 9-15, 18, 30, 48-50.

50-80 cm long: not 1-5, 9-18, 20, 25, 27, 30, 31, 33, 37-41, 45-51.

More than 80 cm long: not 1-20, 22-31, 33, 37-42, 45-52 *(leaving only 21, 32, 34-36, 43, and 44).*

Ternate: blade divided into three nearly equal parts

Pinnatifid: blade dissected more than half way but not all the way to the midvein

Pinnate: blade dissected to the midvein (rachis) but pinnae not deeply lobed

Pinnate-pinnatifid: blade dissected to the rachis forming pinnae which are deeply lobed

Bipinnate: blade with pinnae dissected to form pinnules, the pinnules with entire or toothed margins but not deeply lobed

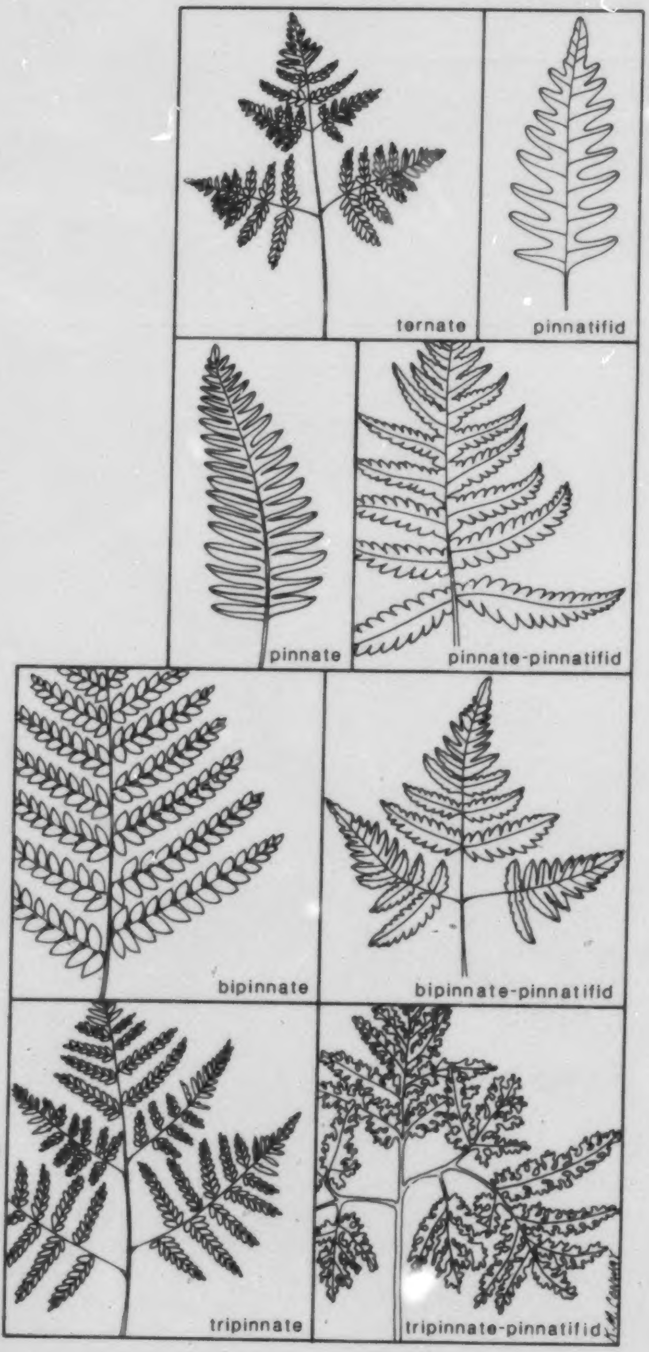
Bipinnate-pinnatifid: blade twice fully dissected with pinnules deeply lobed

Tripinnate: blade three times dissected forming pinnae, pinnules, and pinnulets

Tripinnate-pinnatifid: blade with pinnae, pinnules, and pinnulets, the latter deeply lobed

Quadripinnate: similar to tripinnate-pinnatifid but with the pinnulets dissected all the way to the midvein

Length: from base of blade (upper part of stipe) to tip


ternate
pinnatifid
pinnate
pinnate-pinnatifid
bipinnate
bipinnate-pinnatifid
tripinnate
tripinnate-pinnatifid

STIPES (of leafy blades)

Length

About ¼ or less as long as blade: not 1, 3, 6-8, 10-12, 15, 16, 18, 20-24, 26, 27, 29-31, 33, 36-41, 46, 47, 50, 52.

About ½ as long as blade: not 2, 4, 5, 10-12, 15, 16, 18, 25, 26, 29-33, 36, 39, 40, 43, 45, 47, 52.

About ¾ as long as blade: not 2, 4, 5, 10, 12, 16, 18, 19, 25, 30, 32-35, 39, 40, 42, 43, 45, 52.

About same length as blade: not 2, 4, 5, 7, 8, 10, 12, 17, 19, 21, 25, 28, 32-35, 37, 38, 42, 43, 45, 48, 49, 51, 52.

At least 1½ times as long as blade: not 1, 2, 4-8, 17, 19-29, 31, 32, 34-38, 41-43, 45, 48-52.

Hairs

With hairs above the middle: not 1, 3-6, 10, 11, 18-20, 22-24, 26, 28-31, 33, 36, 41, 42, 44, 47, 49, 52.

Without hairs above the middle: not 17, 27, 37, 39, 50.

Scales

With scales above the middle: not 1, 3, 9-21, 30, 34-36, 38, 41, 44, 45, 47, 49, 52.

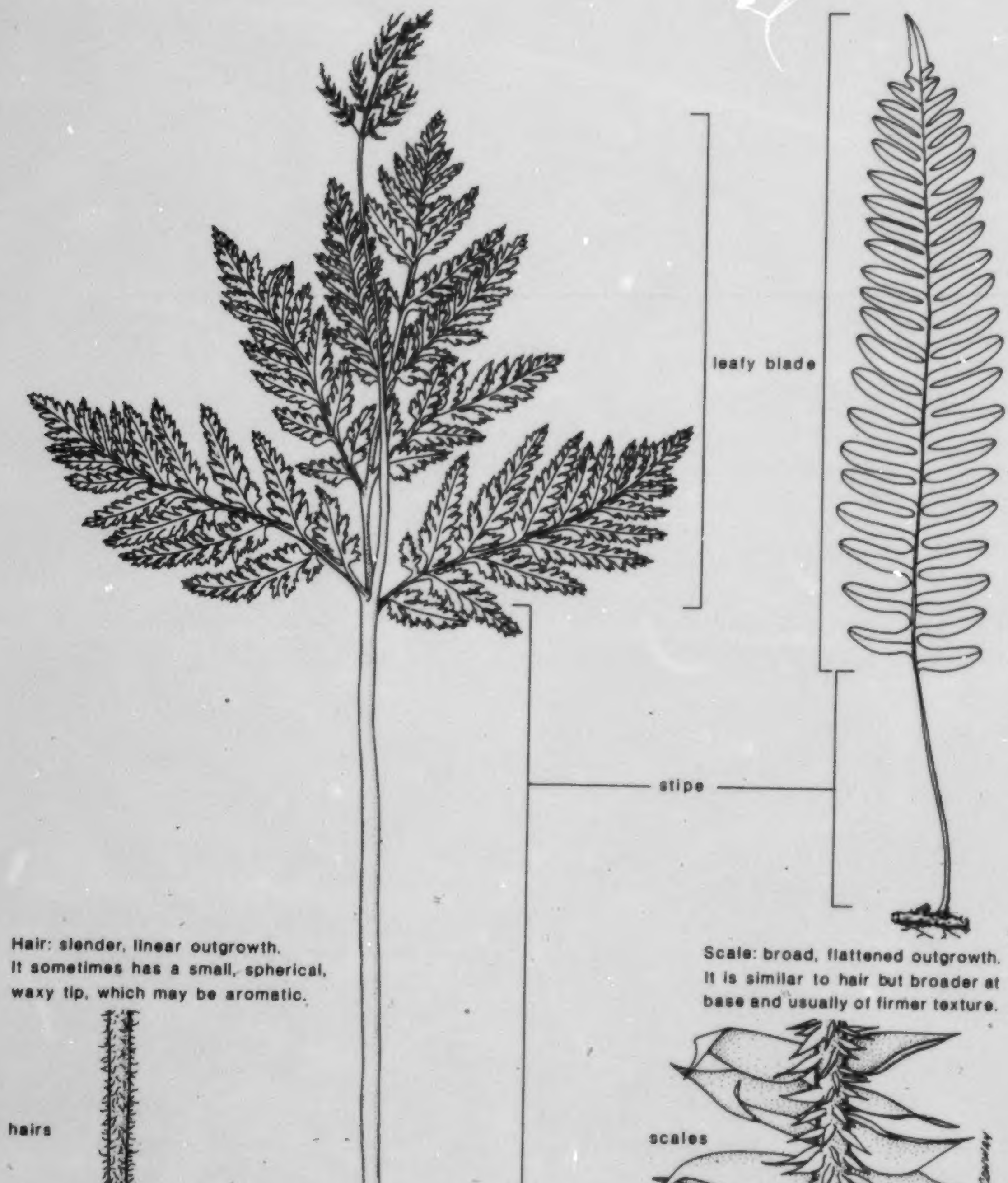
Without scales above the middle: not 22, 25-29, 39, 42, 43, 50, 51.

Color (fresh specimens)

Greenish above the middle: not 2, 4, 17, 19, 22-29, 33, 37-40, 44.

Brown, straw-colored, or yellowish above the middle: not 1, 3, 5-8, 18, 32, 42, 45, 46.

Reddish, purplish, or blackish above the middle: not 1, 3, 5, 7, 8, 10-15, 18, 20, 22-30, 32, 33, 39-49, 51.


leafy blade
stipe
hairs
scales
K.M. Conway

Hair: slender, linear outgrowth.
It sometimes has a small, spherical, waxy tip, which may be aromatic.

Scale: broad, flattened outgrowth.
It is similar to hair but broader at base and usually of firmer texture.

Bundles at Base of Stipe

With 1 circular or slightly curved or V-shaped or X-shaped bundle: not 6-16, 19, 20, 22-36, 39-47, 52.

With 1 horseshoe-shaped bundle strongly curled in at the ends: not 1-33, 37-52 *(leaving only 34, 35, and 36).*

With 1 horseshoe-shaped bundle not curled in at the ends: not 1-8, 16-20, 22-36, 39-52 *(leaving only 9-15, 21, 37, and 38).*

With 2 circular bundles: not 6-16, 18, 21-29, 32-38, 42-45, 47, 52.

With 2 oval, oblong, or linear bundles: not 18, 21-29, 34-38, 41-44, 52.

With 2 bundles of any shape: not 18, 21-29, 34-38, 42-44, 52.

With 3-9 all circular bundles: not 1-21, 30-40, 44-51 *(leaving only 22-29, 41-43, and 52).*

With 3-9 bundles (at least some linear): not 1-8, 17-42, 45-51 *(leaving only 9-16, 43, 44, and 52).*

With 10 or more bundles: not 1-43, 45-52 *(leaving only 44).*

PINNAE OF LEAFY BLADES

Number (below the pinnatifid apex)

With 1-4 pairs: not 1, 2, 4-8, 16, 17, 19-32, 34, 35, 37-52.

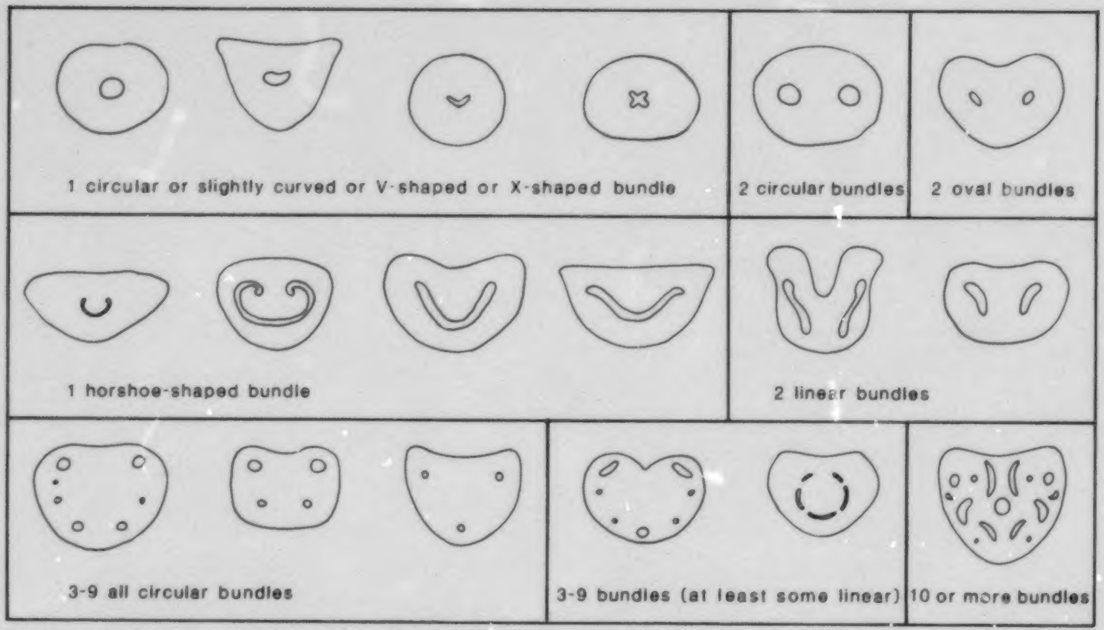
With 5-8 pairs: not 2, 4-8, 17, 19-29, 32, 34, 35, 39, 40, 42, 43, 45-47, 52.

With 9-14 pairs: not 2, 3, 6-10, 12-15, 18, 19, 21, 32, 43, 45, 47, 52.

With 15-24 pairs: not 1, 3, 9-15, 18, 30, 31, 36-38, 40.

With 25-34 pairs: not 1, 3, 5, 8-18, 20, 22-24, 28, 30, 31, 33, 36-38, 40, 41, 44, 48-52.

With 35 or more pairs: not 1, 3-5, 7-18, 20, 22-24, 27-31, 33-41, 44, 48-52.

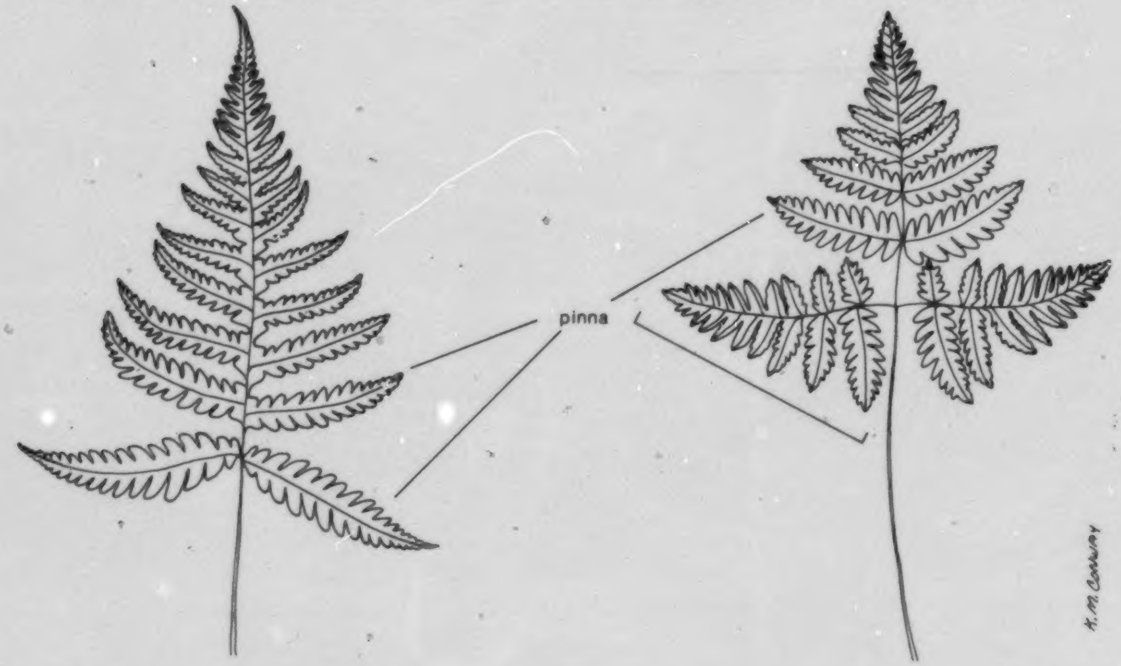

1 circular or slightly curved or V-shaped or X-shaped bundle
2 circular bundles
2 oval bundles
1 horshoe-shaped bundle
2 linear bundles
3-9 all circular bundles
3-9 bundles (at least some linear)
10 or more bundles

Bundle: group of specialized cells (conducting tubes and fibers) that, in cross-section, appear much different from the surrounding tissue. Do not confuse with cavities that may be present.

Linear: longer than wide, at least 1.5 times.

Oval: slightly longer than wide.

Pinna (pinnae): primary division of a dissected blade. It may be undivided or divided one or more times.


pinna
K.M. Conway

Length of Lowest Pinnae

About ¼ or less as long as middle pinnae: not 1, 3-5, 9-24, 26-31, 33-42, 44, 46-52 *(leaving only 2, 6-8, 25, 32, 43, and 45).*

About ½ as long as middle pinnae: not 1, 3-5, 9-23, 26-33, 36-47, 50, 52 *(leaving only 2, 6-8, 24, 25, 34, 35, 48, 49, and 51).*

About ¾ as long as middle pinnae: not 1-3, 10, 12-14, 16-19, 22, 25, 30-33, 37-40, 43-45.

About same length as middle pinnae: not 2, 7, 8, 24, 25, 32, 43, 45.

At least 1½ times as long as middle pinnae: not 2, 4, 5, 7, 8, 11, 17, 18, 20-29, 31-36, 41-43, 45-52.

Position of Lowest Pinnae

Opposite or nearly so: not 3, 31, 32.

Alternate: not 5, 10-17, 30, 33, 36-40, 42, 44.

Attachment of Lowest Pinnae

Sessile with a broad attachment: not 1, 3-10, 13, 14, 16-30, 32-38, 42-52 *(leaving only 2, 11, 12, 15, 31, 39, 40, and 41).*

Sessile with a narrow attachment: not 2, 3, 22-24, 26, 27, 29, 30, 33, 36, 37, 41, 44.

With a stalk: not 2, 4, 5, 8, 11, 12, 31, 32, 39-41, 45, 47-50, 52.

Leafy Margin

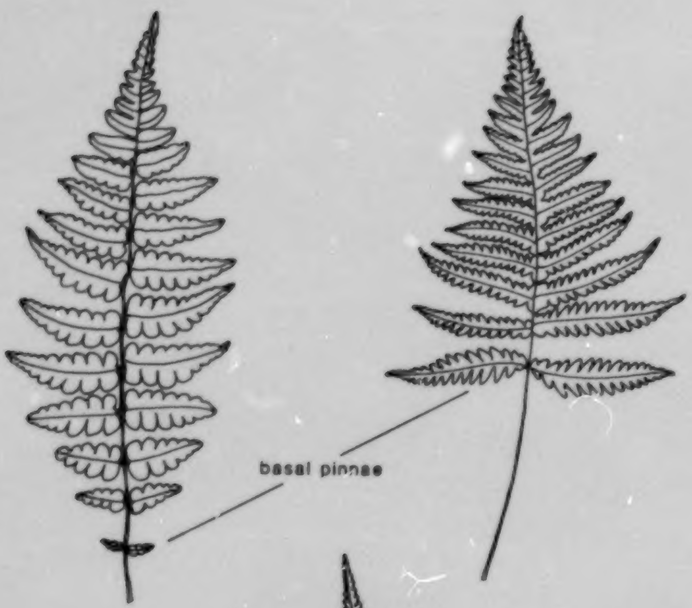
Entire (may be lobed): not 1, 2, 5, 16, 19-27, 29, 42, 43, 51.

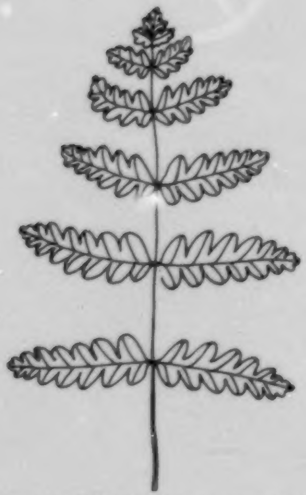
Ciliate: not 1-38, 41-44, 46-52 *(leaving only 39, 40, and 45).*

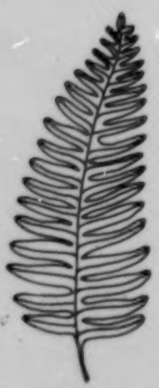
With tiny teeth: not 1, 5, 7, 10, 12, 15, 17, 22, 26, 27, 29, 33-35, 37-40, 42-44, 47, 48.

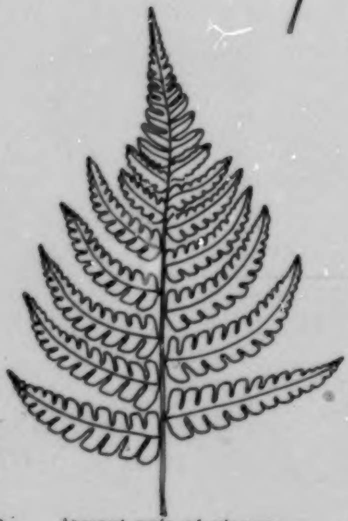
With large teeth but not bristle-tipped: not 3, 7-10, 12, 15, 17, 19, 20, 22, 27-29, 31-50, 52.

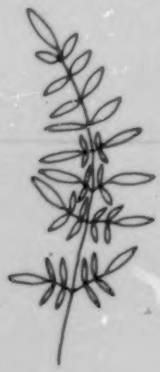
With bristle-tipped teeth: not 1-21, 25, 28, 30-41, 44-52 *(leaving only 22, 23, 24, 26, 27, 29, 42, and 43).*

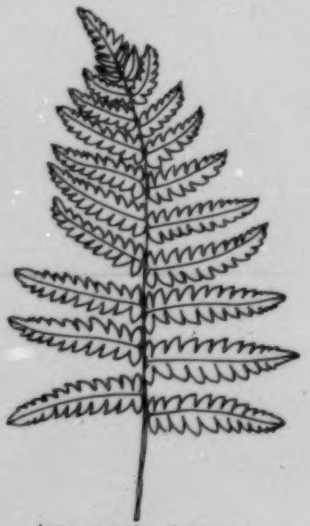

basal pinnae

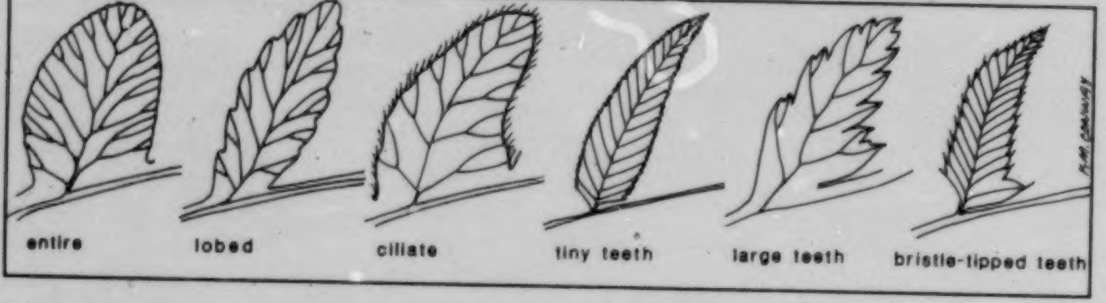

lowest pair of pinnae opposite


lowest pair of pinnae
broadly sessile


lowest pair of pinnae
narrowly sessile


lowest pair of pinnae
with a stalk


lowest pair of pinnae
alternate


entire
lobed
ciliate
tiny teeth
large teeth
bristle-tipped teeth

VEINS (from a midvein)

Branching

Mostly reticulate: not 1-30, 32, 34-51 *(leaving only 31, 33, and 52).*

Not reticulate and mostly not forked: not 2, 4, 6, 7, 9-15, 17, 18, 22-24, 26-29, 31, 33-36, 41-44, 48-52.

Not reticulate and mostly forked only once: not 8, 30-33, 44, 47.

Not reticulate and mostly forked two or more times: not 2, 4, 8, 25, 30-35, 39, 45, 47.

Ending

Extend to the margin: not 1-5, 21, 41, 48-51.

Mostly end before the margin, usually with enlarged tips: not 6-16, 19, 20, 30-40, 42-47, 52.

SORI ON LEAFY BLADES

Shape

Circular: not 1-16, 31-36, 44, 52.

Linear: not 9-16, 19-30, 32-36, 39-43, 45-51.

Position

Marginal or nearly so: not 1-16, 19, 22-27, 29, 31-36, 42, 43, 47, 52.

Not marginal: not 9-16, 18, 21, 28, 30, 32-38, 44.

INDUSIA ON LEAFY BLADES

Peltate: not 1-41, 44-52 *(leaving only 42 and 43).*

Reniform: not 1-5, 7-21, 30-44, 48-52 *(leaving only 6, 22-29, 45, 46, and 47).*

Peltate or reniform: not 1-5, 7-21, 30-41, 44, 48-52.

Cuplike or hoodlike: not 1-18, 22-47, 52 *(leaving only 19-21 and 48-51).*

Raylike: not 1-47, 52 *(leaving only 48-51).*

Laterally attached but not at the pinna margin: not 9-18, 21-30, 32-51.

Only the reflexed margin: not 1-16, 19-36, 39-43, 45-52 *(leaving only 17, 18, 37, 38, and 44).*

SPORES

Shape

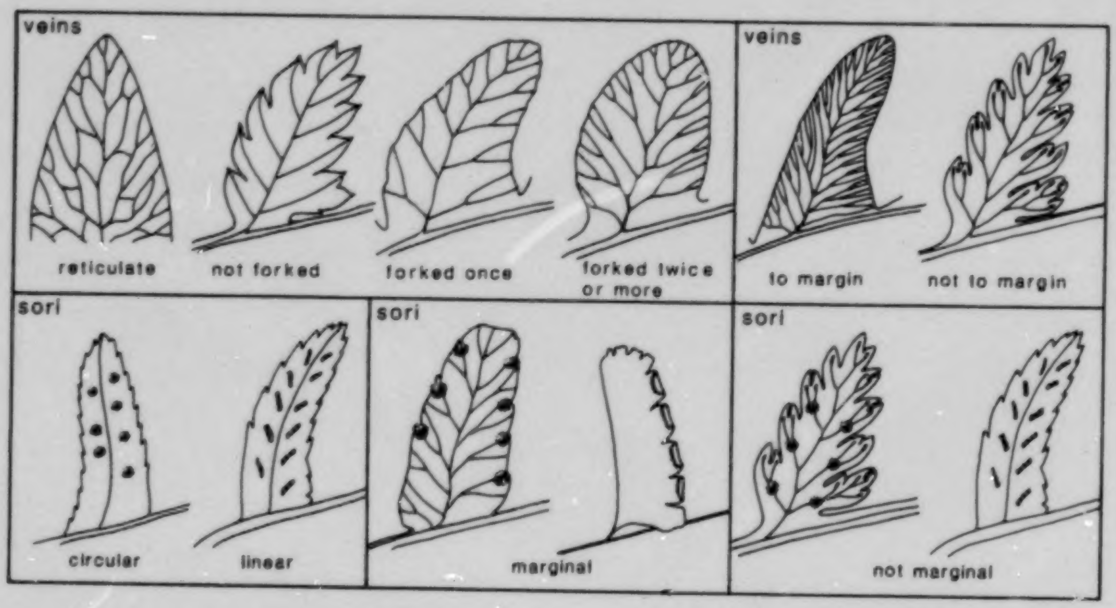
Plano-convex: not 9-18, 21, 34-38, 44.

Circular or triangular: not 1-8, 19, 20, 22-33, 39-43, 45-52.

Surface

Spiny: not 1-18, 21-52 *(leaving only 19 and 20).*

Not spiny: not 19, 20.


veins
reticulate
not forked
forked once
forked twice or more
veins
to margin
not to margin
sori
circular
linear
sori
marginal
sori
not marginal

Sorus (sori): area where the spores are formed.

Linear: longer than wide, at least 1.5 times the width.

Indusium (indusia): a pale covering over or around a sorus.

Peltate: umbrella-like, circular on top with a central stalk.

Reniform: kidney-shaped, similar to peltate but with a notch or sinus.

Cuplike: attached at base and surrounding the sorus.

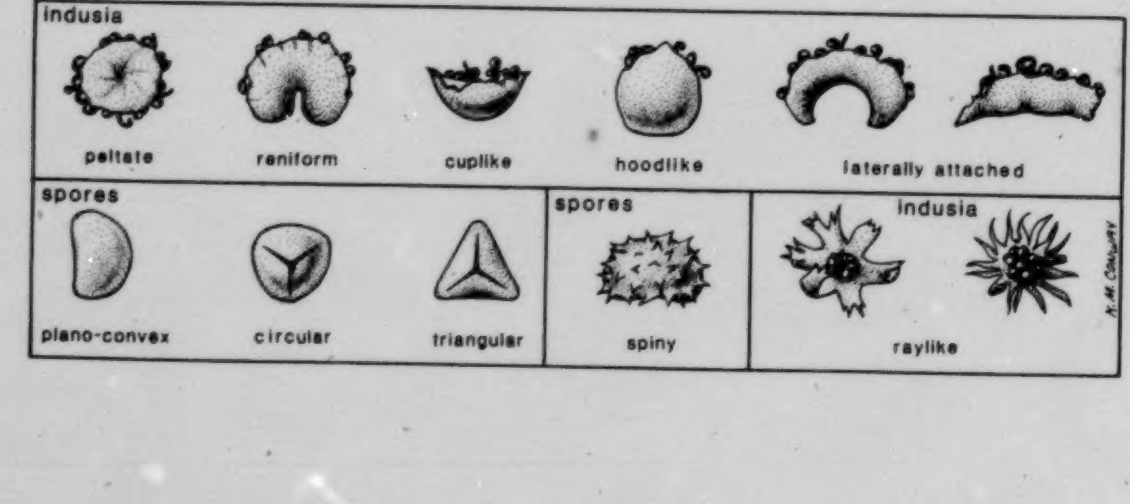
Hoodlike: arching over the sorus in a bladder-like fashion.

Laterally attached: attached at one side only.

Raylike: similar to cuplike but splitting into broad or slender structures.

Reflexed margin: no true indusium, sori partly covered by the inrolled margin of the leafy blade.

Spore: a single-celled reproductive body.


indusia
peltate
reniform
cuplike
hoodlike
laterally attached
spores
plano-convex
circular
triangular
spores
spiny
indusia
raylike
K.M. Conway

Species numbers for random access key

1 Asplenium montanum
2 Asplenium platyneuron
3 Asplenium ruta-muraria
4 Asplenium trichomanes
5 Asplenium viride
6 Athyrium filix-femina
7 Athyrium pycnocarpon
8 Athyrium thelypterioides
9 Botrychium dissectum
10 Botrychium lanceolatum
11 Botrychium lunaria
12 Botrychium matricariifolium
13 Botrychium multifidum
14 Botrychium oneidense
15 Botrychium simplex
16 Botrychium virginianum
17 Cheilanthes lanosa
18 Cryptogramma stelleri
19 Cystopteris bulbifera
20 Cystopteris fragilis
21 Dennstaedtia punctilobula
22 Dryopteris campyloptera
23 Dryopteris clintoniana
24 Dryopteris cristata
25 Dryopteris fragrans
26 Dryopteris goldiana
27 Dryopteris intermedia
28 Dryopteris marginalis
29 Dryopteris spinulosa
30 Gymnocarpium dryopteris
31 Lorinseria areolata
32 Matteuccia struthiopteris
33 Onoclea sensibilis
34 Osmunda cinnamomea
35 Osmunda claytoniana
36 Osmunda regalis
37 Pellaea atropurpurea
38 Pellaea glabella
39 Phegopteris connectilis
40 Phegopteris hexagonoptera
41 Polypodium virginianum
42 Polystichum acrostichoides
43 Polystichum braunii
44 Pteridium aquilinum
45 Thelypteris noveboracensis
46 Thelypteris palustris
47 Thelypteris simulata
48 Woodsia alpina
49 Woodsia glabella
50 Woodsia ilvensis
51 Woodsia obtusa
52 Woodwardia virginica

KEYS TO GROUPS OF SPECIES WITH DISSECTED FRONDS

The eight species illustrated under FERNS WITHOUT FERNLIKE DISSECTED FRONDS (page 3) are not included in these keys.

To use the keys, choose two characters among the 18 listed on the next page. Follow, as in the familiar mileage chart, to the box which gives the proper key number. For example: if you choose leafy blades pinnate and stipes with three to nine all circular bundles you are referred to KEY 24. Mostly the lower the key number the fewer species in the key. These keys are in numerical order and rapidly located. They are of the dichotomous kind found in many identification manuals. Here you determine which one of the first pair (couplet number 1) most nearly describes the specimen. The statement that is chosen will lead to a species name or to a group of species in a genus or to another pair of statements or to another key.

The combination that is chosen reduces the number of possible species anywhere from 1 to 18 of the 52 species involved. Whenever possible, it usually is wise to choose a combination having few species (a low key number). But do not guess. Make sure the characters chosen agree with the fern to be identified. It is nearly always possible to choose more than one combination leading to different keys, some of which may be easier to use than others.

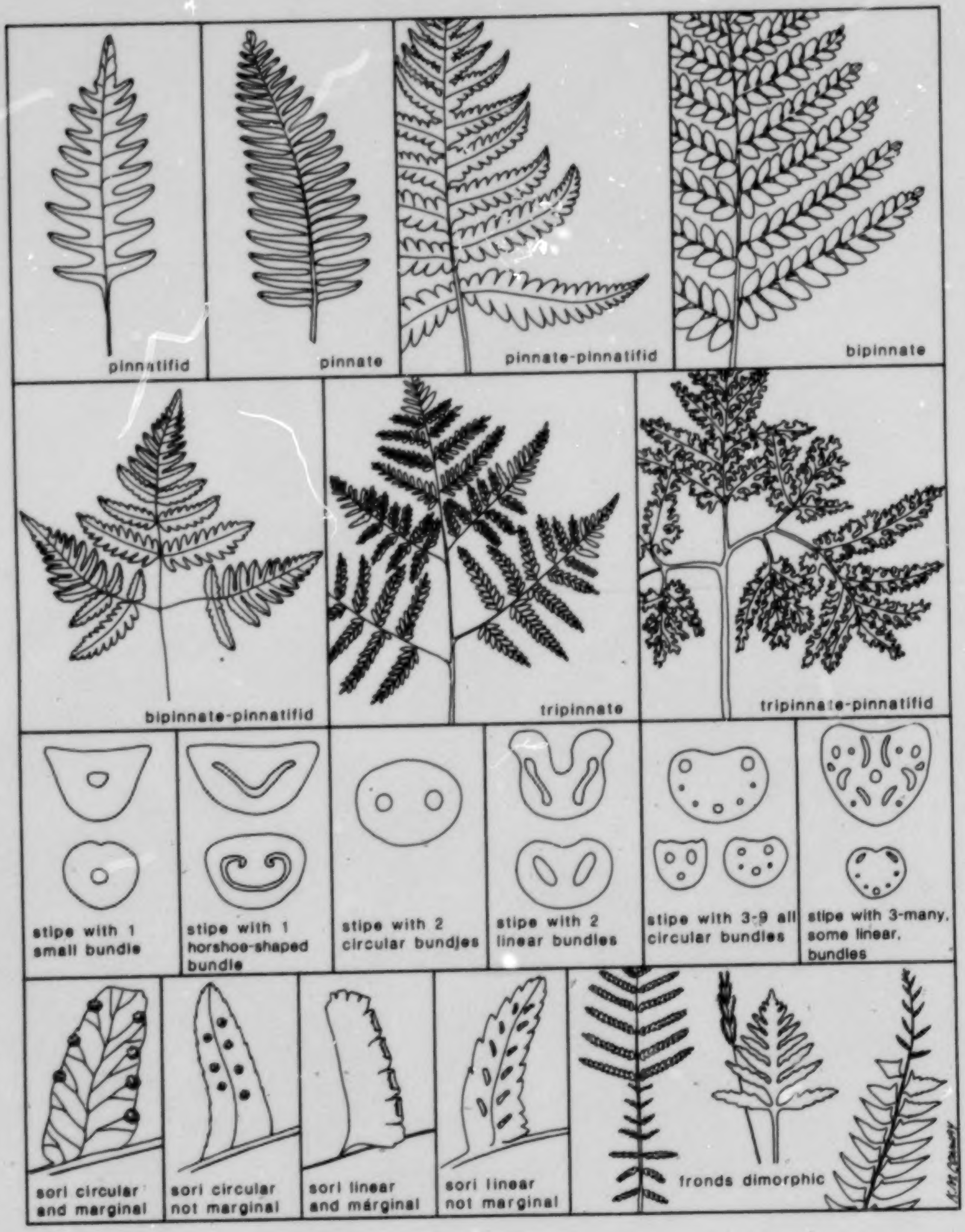
If a key leads to a genus, refer to the KEYS TO SPECIES WHEN GENUS IS KNOWN, where the genera are listed in alphabetical order.

When the specimen exhibits insufficient characters for making a decision as to which leg of a dichotomous key to choose, it may be necessary to try both legs and compare the end results with the illustrated descriptions or refer to the RANDOM ACCESS KEY TO SPECIES WITH DISSECTED FRONDS.

KEYS TO GROUPS OF SPECIES WITH DISSECTED FRONDS

Choose two characters to determine the key number.

	Leafy blades pinnatifid	Leafy blades pinnate	Leafy blades pinnate-pinnatifid	Leafy blades bipinnate	Leafy blades bipinnate-pinnatifid	Leafy blades tripinnate	Leafy blades tripinnate-pinnatifid or quadripinnate	Stipes at base with one small bundle	Stipes at base with one large horshoe-shaped bundle	Stipes at base with two circular bundles	Stipes at base with two linear bundles	Stipes with three to nine all circular bundles	Stipes with three to many (some or all linear) bundles	Sori on leafy blades circular and marginal	Sori on leafy blades circular and not marginal	Sori on leafy blades linear and marginal	Sori on leafy blades linear and not marginal
Leafy blades pinnate																	
Leafy blades pinnate-pinnatifid																	
Leafy blades bipinnate																	
Leafy blades bipinnate-pinnatifid																	
Leafy blades tripinnate																	
Leafy blades tripinnate-pinnatifid or quadripinnate																	
Stipes at base with one small bundle		52	62	63	39	13	3										
Stipes at base with one large horshoe-shaped bundle	1	55	60	83	44	47	30										
Stipes at base with two circular bundles	6	51	77	70	64	40	4										
Stipes at base with two linear bundles	32	74	91	90	84	65	30										
Stipes with three to nine all circular bundles	6	24	69	76	61	37											
Stipes with three to many (some or all linear) bundles	1	31	42	67	54	54	46										
Sori on leafy blades circular and marginal	6	38	87	87	87	34	15	68	36	80	72	19					
Sori on leafy blades circular and not marginal	6	24	89	88	88	58		56		79	85	75					
Sori on leafy blades linear and marginal		23	35	48	33	33	17	49	23	2	2		9				
Sori on leafy blades linear and not marginal	5	50	27	49	40	12		57		59	73	10	10				
Dimorphic fronds	31	71	81	82	53	47	43	28	78	29	86	7	66	16	25	16	41


pinnatifid
pinnate
pinnate-pinnatifid
bipinnate
bipinnate-pinnatifid
tripinnate
tripinnate-pinnatifid
stipe with 1 small bundle
stipe with 1 horshoe-shaped bundle
stipe with 2 circular bundjes
stipe with 2 linear bundles
stipe with 3-9 all circular bundles
stipe with 3-many, some linear, bundles
sori circular and marginal
sori circular not marginal
sori linear and marginal
sori linear not marginal
fronds dimorphic

KEY 1

.... *Botrychium simplex*

KEY 2

.... *Cheilanthes lanosa*

KEY 3

.... *Cryptogramma stelleri*

KEY 4

.... *Gymnocarpium dryopteris*

KEY 5

.... *Lorinseria areolata*

KEY 6

.... *Polypodium virginianum*

KEY 7

.... *Polystichum acrostichoides*

KEY 8

.... *Polystichum braunii*

KEY 9

.... *Pteridium aquilinum*

KEY 10

.... *Woodwardia virginica*

KEY 11

1. Stipes green throughout, slender; blades with 2-6 pairs of pinnae; veins of pinnules fanlike.......... *Asplenium ruta-muraria*
1. Stipes brown at base, green above; blades with 5-12 pairs of pinnae; veins obscure.......... *Asplenium montanum*

KEY 12

1. Stipes and rachises glabrous or with a few hairs, with scales; fronds usually 40-90 cm long; sori linear, usually curved; indusia laterally attached.......... *Athyrium filix-femina*
1. Stipes and rachises densely covered with brownish hairs, without scales; fronds usually 10-30 cm long; sori circular to oblong; indusia only the reflexed, unmodified, green margin of the pinnule.......... *Cheilanthes lanosa*

KEY 13

1. Stipes and rachises densely covered with brownish hairs; fronds not dimorphic, with 12-20 pairs of pinnae.......... *Cheilanthes lanosa*
1. Stipes hairy only at base, glabrous above, rachises glabrous; fronds dimorphic; sterile fronds with 5 or 6 pairs of pinnae.......... *Cryptogramma stelleri*

KEY 14

1. Stipes and rachises densely covered with brownish hairs; blades less than 10 cm long; stipes with 1 or 2 bundles.......... *Cheilanthes lanosa*
1. Stipes and rachises glabrous; blades more than 20 cm long; stipes with more than 8 bundles.......... *Pteridium aquilinum*

KEY 15

1. Fronds dimorphic; blades not ternate; stipes with 1 bundle.......... *Cryptogramma stelleri*
1. Fronds not dimorphic; blades ternate, each third triangular; stipes with 2 bundles.......... *Gymnocarpium dryopteris*

KEY 16

1. Blades bipinnate to quadripinnate (rarely only pinnate-pinnatifid), mostly less than 8 cm long and 5 cm wide; pinnule margins dentate or crenate, stipes weak, greenish.......... *Cryptogramma stelleri*
1. Blades pinnate above to bipinnate below, mostly more than 10 cm long and 5 cm wide; pinnule margins entire; stipes wiry, purplish or reddish or nearly black, shiny.......... *Pellaea atropurpurea*

KEY 17

1. Blades less than 10 cm long; first division not ternate; stipes with 1 bundle.......... *Cryptogramma stelleri*
1. Blades more than 20 cm long; first division usually ternate; stipes with several bundles.......... *Pteridium aquilinum*

KEY 18

1. Fronds with hairs on stipe, rachis, and indusia; the second pinnule from the rachis on the lower side of the lowest pinna usually the longest.......... *Dryopteris intermedia*
1. Fronds without hairs; the pinnule closest to the rachis on the lower side of the lowest pinna longer than the other pinnules.......... *Dryopteris spinulosa*

KEY 19

1. Stipes densely scaly, with 3-9 bundles at base and upward; indusia reniform .. *Dryopteris marginalis*
1. Stipes without scales above the middle, with 3 bundles at extreme base, soon becoming 2 and then 1 upward; indusia absent .... *Polypodium virginianum*

KEY 20

1. Pinnae alternate; margins serrulate; fertile pinnae bladelike; sori linear .... *Lorinseria areolata*
1. Pinnae opposite or mostly so; margins entire; fertile pinnae resemble strings of beads; sori spherical .... *Onoclea sensibilis*

KEY 21

1. Fronds dimorphic; veins mostly reticulate........ .... *Lorinseria areolata*
1. Fronds not dimorphic; veins not reticulate....... .... *Polypodium virginianum*

KEY 22

1. Fertile and sterile pinnae on separate blades; sterile pinnae (when young) with tuft of hairs at base .... *Osmunda cinnamomea*
1. Fertile and sterile pinnae on the same blade; sterile pinnae without tuft of hairs at base .... *Osmunda claytoniana*

KEY 23

.... species of *Pellaea*

KEY 24

1. Stipes without scales above the middle, with 2 or 3 bundles at base ....*Polypodium virginianum*
1. Stipes densely scaly, with 4 or 5 bundles at base .... *Polystichum acrostichoides*

KEY 25

1. Stipes densely scaly; pinnae auricled, margins with bristle-tipped teeth; stipes with 4 or 5 bundles at base .... *Polystichum acrostichoides*
1. Stipes with a few scales when young; pinnae without an auricle; margins entire or shallowly toothed; stipes with 2 bundles at base........... .... *Thelypteris palustris*

KEY 26

1. Stipes and rachises with many hairs and scales; stipes with a joint at or below the middle (old stipe bases rather uniform in length); indusia with many hairlike rays .... *Woodsia ilvensis*
1. Stipes and rachises with a few hairs and scales; stipes not jointed (old stipe bases uneven in length); indusia with 3–6 short scalelike rays .... *Woodsia obtusa*

KEY 27

1. Veins mostly free but reticulate along the midvein; stipes with 5-9 bundles at base; sori in chainlike rows along the midveins .. *Woodwardia virginica*
1. Veins all free; stipes with 2 bundles at base; sori scarcely in chainlike rows 2
    2. Pinnae 15-20 pairs per blade, sessile, lowest pair shorter than middle pinnae and usually pointing downward; stipes with 2 linear bundles at base .... *Athyrium thelypterioides*
    2. Pinnae 5-12 pairs per blade, stalked, lowest pair usually longer than middle pinnae; stipes with 1 or 2 circular or oval bundles at base .... *Asplenium montanum*

KEY 28

1. Blades pinnate; pinnae of sterile blades 15-25, lowest much shorter than middle pinnae; rachises dark brown, shiny, with scales .... *Asplenium platyneuron*
1. Blades mostly bipinnate, at least below; pinnae of sterile blades 5-11, lowest as long or longer than middle pinnae; rachises without scales, glabrous or with rough hairs .... KEY 16

KEY 29

1. Veins mostly reticulate .... *Lorinseria areolata*
1. Veins not reticulate 2
    2. Blades pinnate; rachises with scales; lowest pair of pinnae much shorter than middle pinnae; sori short-linear; indusia laterally attached..... .... *Asplenium platyneuron*
    2. Blades pinnate-pinnatifid to bipinnate; rachises with tiny hairs; lowest pair of pinnae about same length or slightly shorter than middle pinnae; sori circular; indusia reniform, often circular but with a sinus ..... *Thelypteris palustris*

KEY 30

1. Sterile blades thick, leathery or fleshy; pinnule segments of similar size and shape and mostly about twice as long as wide with ultimate lobes or teeth not parallel-sided and mostly obtuse at apex; terminal segments not elongate .... *Botrychium multifidum*
1. Sterile blades thin or slightly leathery; pinnule segments variable in size and shape; terminal segments elongate 2
    2. Sterile blades sometimes lacelike in appearance; pinnule segments usually more than twice as long as wide with ultimate lobes or teeth somewhat parallel-sided and mostly acute at apex .. .. *Botrychium dissectum*
    2. Sterile blades not lacelike; pinnule segments about as long as wide with ultimate lobes or teeth mostly obtuse at apex .... *Botrychium oneidense*

KEY 31

1. Common stipe longer than stalk of fertile blade; pinnae not fanlike, not cuneate at base, acute or obtuse at apex ...... *Botrychium matricariifolium*
1. Common stipe shorter to longer than stalk of fertile blade; pinnae fanlike, cuneate at base, rounded at apex 2
    2. Sterile blade sessile or with a stalk less than 1/5 as long as blade, with 3-10 pairs of pinnae that are at a right-angle to the rachis .... *Botrychium lunaria*
    2. Sterile blade with a stalk 1/3 to 1/2 as long as blade, with 1-5 pairs of pinnae that usually are oblique to the rachis ..... *Botrychium simplex*

KEY 32

1. Veins of leafy blades mostly reticulate ...KEY 20
1. Veins of leafy blades mostly free................ .... *Botrychium simplex*

KEY 33

1. Blades less than 8 cm wide; stipes with 1 or 2 bundles .... KEY 13
1. Blades more than 10 cm wide; stipes with more than 8 bundles .... *Pteridium aquilinum*

KEY 34

1. Stipes and rachises densely covered with brownish hairs .... *Cheilanthes lanosa*
1. Stipes and rachises glabrous or nearly so 2
    2. Blades ternate, each third triangular .... *Gymnocarpium dryopteris*
    2. Blades not ternate .... *Cystopteris fragilis*

KEY 35

1. Blades bipinnate to quadripinnate (rarely pinnate-pinnatifid); mostly less than 10 cm long and 5 cm wide; pinnule margins dentate or crenate; stipes weak, greenish .... *Cryptogramma stelleri*
1. Blades pinnate above to bipinnate below; mostly more than 10 cm long and 5 cm wide; pinnule margins entire; stipes wiry, purplish or reddish or nearly black, shiny .... species of *Pellaea*

KEY 36

1. Pinnae more than 15 pairs, with many small whitish gland-tipped hairs, margins serrate; indusia cuplike .... *Dennstaedtia punctilobula*
1. Pinnae fewer than 12 pairs, glabrous or with a few hairs, margins entire; indusia absent but with an indusium-like reflexed margin of the blade....... .... species of *Pellaea*

KEY 37

1. Fronds with short, glandular hairs on stipes, rachis, and indusia; lowest basal pinnule on lower side of lowest pinna shorter than pinnule next above .... *Dryopteris intermedia*
1. Fronds without hairs; lowest basal pinnule on lower side of lowest pinna longer than pinnule next above 2
    2. Basal pair of pinnules of lowest pinnae opposite or nearly so (4 mm or less apart); the lowest basal pinnule about twice as long and slightly wider at base than the opposing basal pinnule .... *Dryopteris spinulosa*
    2. Basal pair of pinnules of lowest pinnae alternate (4 mm or more apart); the lowest basal pinnule two or three times as long and much wider at base than the opposing basal pinnule......... .... *Dryopteris campyloptera*

KEY 38

1. Blades pinnate above to bipinnate below; stipes with 1 linear, curved bundle ...species of *Pellaea*
1. Blades never bipinnate; stipes with 2 or 3 circular bundles at base .... *Polypodium virginianum*

KEY 39

1. Pinnae sessile; sori circular; indusia cuplike when young, raylike with age .... *Woodsia obtusa*
1. Pinnae with stalks, at least the lowest pair; indusia not cuplike or raylike 2
    2. Stipes wiry, densely covered with brownish hairs, without scales; blades with 12-20 pairs of pinnae; indusia only the reflexed margin of the fertile pinnules .... *Cheilanthes lanosa*
    2. Stipes glabrous or with a few hairs at base; blades with 5-12 pairs of pinnae 3
3. Fertile and sterile fronds similar; sori linear, not marginal; indusia laterally attached .... *Asplenium montanum*
3. Fertile fronds longer than sterile fronds; sori marginal; true indusium absent, a false indusium when young opens flat with age .... *Cryptogramma stelleri*

KEY 40

1. Stipes and rachises densely covered with brownish hairs, without scales; indusia only the reflexed, unmodified, green margin of the pinnule .... *Cheilanthes lanosa*
1. Stipes and rachises glabrous or with a few hairs; indusia laterally attached 2
    2. Blades with 2-12 pairs of pinnae; stipes with 2 oval bundles at base; sori usually fewer than 15 per pinna .... KEY 11
    2. Blades with 15-40 pairs of pinnae; stipes with 2 long, linear, curved bundles at base; sori usually more than 20 per pinna...................................... *Athyrium filix-femina*

KEY 41

1. Veins mostly reticulate, only the outer ones free .... *Lorinseria areolata*
1. Veins mostly not reticulate 2
    2. Blades 2-7 cm wide; stipes with 1 or 2 circular or oval bundles at base; sori fewer than 15 per pinna .... *Asplenium platyneuron*
    2. Blades mostly more than 10 cm wide; stipes with 2 linear bundles at base; sori more than 20 per pinna 3
3. Fronds pinnate, margins not lobed; rachises without scales .... *Athyrium pycnocarpon*
3. Fronds pinnate-pinnatifid; rachises with a few scales .... *Athyrium thelypterioides*

KEY 42

1. Fronds dimorphic; sori absent on leafy blades .. 2
1. Fronds not dimorphic; sori oblong-linear, forming two rows along the midveins .... *Woodwardia virginica*
    2. Common stipes 0.5-6 cm long, much shorter than stalk of fertile blade; stalks of sterile blades more than 2 cm long ... *Botrychium dissectum*
    2. Common stipes 6-20 cm long, much longer than stalk of fertile blade; stalks of sterile blades less than 2 cm long 3
3. Stalks of sterile blades 0-0.6 cm long; stalks of fertile blades 0.5-1.3 cm long; sterile blades pinnate-pinnatifid or bipinnate ... *Botrychium lanceolatum*
3. Stalks of sterile blades 0.2-1.5 cm long; stalks of fertile blades 1-4 cm long; sterile blades pinnate or pinnate-pinnatifid .... *Botrychium matricariifolium*

KEY 43

1. Fertile and sterile blades with separate stalks but with a common stipe; fertile blades not leaflike; stipes more than 1 mm in diameter, with 1 to several bundles in a nearly closed ring .. KEY 30
1. Fertile and sterile blades on separate stipes, both blades leaflike; stipes less than 1 mm in diameter, with 1 circular or slightly curved bundle .... *Cryptogramma stelleri*

KEY 44

1. Fronds dimorphic with fertile and sterile blades from a common stipe; croziers absent; rachises and pinnae of leafy blades glabrous; sori absent on leafy blades .... KEY 30
1. Fronds not dimorphic; croziers covered with silvery-white, glandular hairs; rachises and pinnae with many small, whitish, gland-tipped hairs; sori on leafy blades .... *Dennsteadtia punctilobula*

KEY 45

1. Fronds dimorphic; leafy blades without sori... KEY 30
1. Fronds not dimorphic; sori on leafy blades.............................. *Gymnocarpium dryopteris*

KEY 46

1. Fronds dimorphic; leafy blades less than 30 cm wide; stipe bundles linear and arranged in a ring; sori absent on leafy blades .... KEY 30

1. Fronds not dimorphic; leafy blades usually more than 30 cm wide; stipe bundles of various sizes and shapes and irregularly arranged; sori long-linear, marginal .... *Pteridium aquilinum*

KEY 47

1. Sterile blades with stalk, evergreen or becoming bronze in color; veins mostly forked several times; bud for following year surrounded by base of stipe .... KEY 30

1. Sterile blades sessile or nearly so; not evergreen; veins mostly forked only once; bud for following year exposed at side of base of stipe .... *Botrychium virginianum*

KEY 48

1. Stipes and rachises densely covered with brownish hairs, without scales; with 12-20 pairs of pinnae .. .. *Cheilanthes lanosa*

1. Stipes and rachises glabrous or with a few hairs; with 5-11 pairs of pinnae .... KEY 35

KEY 49

1. Sori in chainlike rows along the midveins; stipes with 5-9 bundles .... *Woodwardia virginica*

1. Sori scarcely in chainlike rows; stipes with 1 or 2 bundles 2

   2. Stipes with hairs or scales above the middle; blades with 12 or more pairs of pinnae....... .... KEY 12

   2. Stipes without hairs or scales above the middle; blades with 12 or fewer pairs of pinnae ....KEY 11

KEY 50

1. Veins mostly reticulate ...... *Lorinseria areolata*

1. Veins free 2

   2. Blades 10 cm or more wide; middle pinnae usually more than 7 times as long as wide; stipes with 2 linear bundles at base; sori usually more than 20 per pinna ....*Athyrium pycnocarpon*

   2. Blades 7 cm wide or less; middle pinnae usually less than 7 times as long as wide; stipes with 2 oval bundles at base; sori usually fewer than 15 per pinna .... species of *Asplenium* (except *A. montanum* and *A. ruta-muraria*)

KEY 51

1. Fronds dimorphic; veins reticulate ....*Lorinseria areolata*

1. Fronds not dimorphic, veins not reticulate 2

   2. Pinnae alternate; sori circular; indusia absent. . ...*Polypodium virginianum*

   2. Sori (at least some) linear or oblong; indusia laterally attached .... species of *Asplenium* (except *A. montanum* and *A. ruta-muraria*)

KEY 52

1. Sori marginal; indusia only the reflexed, unmodified margin of the pinna ...... species of *Pellaea*

1. Sori not marginal; indusia laterally attached...... species of *Asplenium* (except *A. montanum* and *A. ruta-muraria*)

KEY 53

1. Fertile and sterile blades with a common stipe; fertile blades not leaflike; stipes more than 1 mm in diameter, with 1 to several bundles in a nearly closed ring .... KEY 47

1. Fertile and sterile blades on separate stipes, both blades leaflike; stipes less than 1 mm in diameter, with 1 circular or slightly curved bundle ....*Cryptogramma stelleri*

KEY 54

1. Fronds dimorphic; blades less than 40 cm wide; croziers not formed; stipe bundles linear and arranged in a ring; sori absent on leafy blades ....KEY 47

1. Fronds not dimorphic; blades usually more than 35 cm wide; croziers in groups of three on young plants; stipe bundles of various sizes and shapes and irregularly arranged; sori long-linear, marginal ....*Pteridium aquilinum*

KEY 55

1. Fronds strongly dimorphic with fertile and sterile blades on a common stipe; stipes fleshy, greenish; sori absent on leafy blades .... KEY 31

1. Fronds not or slightly dimorphic; stipes wiry, purplish or reddish; sori on leafy blades circular or oblong .... species of *Pellaea*

KEY 56

1. Stipes and rachises densely covered with brownish hairs, without scales; indusia only the reflexed, unmodified, green margin of the pinnule .... *Cheilanthes lanosa*
1. Stipes glabrous or with few to many hairs, scales usually present; true indusia present, at least when young .... species of *Woodsia*

KEY 57

1. Stipes and rachises densely covered with brownish hairs, without scales; indusia only the reflexed, unmodified, green margin of the blade .... *Cheilanthes lanosa*
1. Stipes and rachises glabrous or with a few hairs; indusia laterally attached ....species of *Asplenium*

KEY 58

1. Stipes with 1 or 2 bundles; pinnule margins entire or with small teeth that are not bristle-tipped; indusia absent or laterally attached .... KEY 34
1. Stipes with 3-9 bundles; pinnule margins with large bristle-tipped teeth; indusia reniform, often circular, but with a sinus .... KEY 37

KEY 59

1. Fronds strongly dimorphic; veins of leafy blades reticulate .... *Lorinseria areolata*
1. Fronds not dimorphic or only slightly so; veins not reticulate .... KEY 57

KEY 60

1. Fronds not, or slightly dimorphic; sori on leafy blades; stipes slender, wiry, purplish or reddish ....species of *Pellaea*
1. Fronds strongly dimorphic, without sori on leafy blades; stipes 2-5 mm in diameter 2
    2. Fronds less than 40 cm long; fertile and sterile blades separate but on a common stipe; stipe bundle not curled in at the ends; croziers not formed 3
    2. Mature fronds usually more than 50 cm long; fertile and sterile blades on separate stipes, or fertile and sterile pinnae on separate parts of the same blade; stipe bundles strongly curled in at the ends; croziers present on young plants ....KEY 22
3. Common stipe 0.5-6 cm long, much shorter than stalk of fertile blade; stalks of sterile blades more than 2 cm long .... *Botrychium dissectum*
3. Common stipe 6-20 cm long, much longer than stalk of fertile blade; stalks of sterile blades less than 2 cm long 4
    4. Stalk of sterile blades 0-0.6 cm long; stalks of fertile blades 0.5-1.3 cm long; sterile blades pinnate-pinnatifid or bipinnate ....*Botrychium lanceolatum*
    4. Stalks of sterile blades 0.2-1.5 cm long; stalks of fertile blades 1-4 cm long; sterile blades pinnate or pinnate-pinnatifid ....*Botrychium matricariifolium*

KEY 61

.... species of *Dryopteris* (except *D. cristata*)

KEY 62

1. Lowest pinnae sessile or nearly so; sori circular; indusia cuplike when young, raylike with age ....species of *Woodsia*
1. Lowest pinnae with short or long stalks; indusia not cuplike or raylike 2
    2. Sori marginal or nearly so; true indusium absent, sori may be covered by the reflexed margins of the pinnae .... KEY 35
    2. Sori linear, not marginal; indusia laterally attached .... *Asplenium montanum*

KEY 63

1. Sori marginal; indusia only the reflexed margin of the pinnules .... KEY 48
1. Sori not marginal; indusia laterally attached or cuplike or raylike 2
    2. Sori linear; indusia laterally attached ....KEY 11
    2. Sori circular; indusia cuplike or raylike ....KEY 26

KEY 64

1. First division of blade ternate, each of the three divisions triangular; stipe bundles free to the base of the blade; croziers in groups of three; sori circular; indusia absent .... *Gymnocarpium dryopteris*
1. Blades not ternate; croziers borne singly 2
    2. Blades broadly triangular, mostly as wide or wider than long; rachises winged; indusia absent .... *Phegopteris hexagonoptera*
    2. Blades longer than wide; rachises not winged 3

3. Stipes wiry, densely covered with brownish hairs, without scales; indusia only the reflexed margins of the fertile segments .... *Cheilanthes lanosa*

3. Stipes glabrous or hairy but not densely so, indusia laterally attached or cuplike or hoodlike or raylike 4

4. Stipe bundles remain separate nearly to the blade .... species of *Cystopteris*

4. Stipe bundles soon united upward 5

5. Pinnae with stalks, lower pair usually longer than middle pinnae; sori linear; indusia laterally attached .... KEY 11

5. Pinnae sessile, lowest pair usually shorter than middle pinnae; sori circular; indusia cuplike when young, raylike with age .... *Woodsia obtusa*

KEY 65

1. Fronds dimorphic; croziers not formed; stipe bundles forming a nearly closed ring .... KEY 47

1. Fronds not dimorphic; croziers present on young plants; stipe bundles not forming a ring 2

2. Blades mostly 10-20 cm long, with 5-20 pairs of pinnae; stipe bundles oval or short-linear; sori circular to oblong .... KEY 34

2. Blades mostly 40-90 cm long, with 15-40 pairs of pinnae; stipe bundles long-linear; sori long-linear and curved, usually hooked at one end . ... *Athyrium filix-femina*

KEY 66

.... species of *Botrychium*

KEY 67

1. Fronds dimorphic; sori absent on leafy blades.... species of *Botrychium* (except *B. lunaria* and *B. virginianum*)

1. Fronds not dimorphic, sori borne on leafy blades. 2

2. Stipes about ¼ as long as blade; blades mostly with 30-40 pairs of pinnae; sori circular....... .... *Polystichum braunii*

2. Stipes about as long as blade; blades mostly with 15-20 pairs of pinnae; sori linear, forming two rows along the midveins .... *Woodwardia virginica*

KEY 68

1. Indusia absent but often with indusium-like reflexed margins of the pinnae .... KEY 48

1. Indusia cuplike when young, raylike with age ....species of *Woodsia*

KEY 69

1. Sori oblong-linear, forming two rows along the midveins; veins mostly free but reticulate along the midveins .... *Woodwardia virginica*

1. Sori circular; veins all free 2

2. Stipes smooth or scurfy above the middle, scales absent or only a few at base, with 3 bundles at extreme base, soon becoming 2 and then 1 upward; indusia absent.................. ....*Polypodium virginianum*

2. Stipes with scales at base and often above the middle, with 3-9 bundles at base and upward; indusia peltate or reniform 3

3. Fronds dimorphic, fertile fronds with much reduced pinnae on upper part of blade; pinnae auriculate on upper side at base ....*Polystichum acrostichoides*

3. Fronds not dimorphic; pinnae not auriculate ..... species of *Dryopteris* (except *D. campyloptera*, *D. intermedia*, and *D. spinulosa*)

KEY 70

1. Blades broadly triangular, mostly as wide or wider than long; rachises winged; indusia absent ....*Phegopteris hexagonoptera*

1. Blades narrowly triangular to ovate, lanceolate, or elliptic, longer than wide 2

2. Stipes wiry, densely covered with brownish hairs, without scales; indusia only the reflexed margins of fertile segments.................. ....*Cheilanthes lanosa*

2. Stipes glabrous or hairy, if densely hairy then with scales also; indusia never of reflexed margins 3

3. Stipe bundles separate nearly to the blade; sori circular .... species of *Cystopteris*

3. Stipe bundles soon united upward 4

4. Sori linear .... KEY 11

4. Sori circular 5

5. Blades 8-20 cm wide; mature stipes without hairs or scales; indusia reniform, often circular but with a sinus .... *Thelypteris palustris*

5. Blades 1-5 cm wide, or if wider then stipes hairy and scaly; indusia cuplike when young, raylike with age .... KEY 26

KEY 71

1. Veins of leafy blades mostly reticulate, only the outer ones free .... KEY 20

1. Veins of leafy blades not reticulate 2

2. Fertile and sterile blades separate, but on a common stipe .... KEY 31

2. Fertile and sterile blades from separate stipes, or fertile and sterile pinnae on the same blade 3

3. Blades pinnate above to bipinnate below, with 5-11 pairs of pinnae; stipes with 1 linear bundle ....*Pellaea atropurpurea*

3. Blades pinnate below, mostly with 15 or more pairs of pinnae; stipes with 2-5 bundles at base 4

4. Stipes and rachises densely scaly; each pinna with an auricle on the upper side at base; stipes with 4 or 5 circular bundles at base and upward; sori circular; indusia peltate, circular without a sinus ... *Polystichum acrostichoides*

4. Stipes and rachises with few or no scales; stipes with 2 oval or linear bundles at base; sori linear; indusia laterally attached 5

5. Blades 2-7 cm wide; pinnae oblong, length less than 3 times the width; sori fewer than 15 per pinna .... *Asplenium platyneuron*

5. Blades 10-15 cm wide; pinnae linear-lanceolate, length more than 5 times the width; sori usually more than 20 per pinna .. *Athyrium pycnocarpon*

KEY 72

1. Blades ternate, each third triangular; stipe bundles free nearly to the blade........................ ....*Gymnocarpium dryopteris*

1. Blades not ternate 2

2. Blades broadly triangular, at least 2/3 as wide as long; rachises winged; indusia absent......... ....species of *Phegopteris*

2. Blades narrowly triangular or ovate or elliptic 3

3. Stipes densely covered with brownish hairs, without scales; indusia only the reflexed, unmodified, green margins of the pinnules............ ....*Cheilanthes lanosa*

3. Stipes glabrous or with hairs; true indusia present, at least on young sori 4

4. Stipe bundles separate nearly to the blade; rachises without scales; indusia laterally attached, hoodlike .... *Cystopteris fragilis*

4. Stipe bundles soon united upward; indusia cuplike when young, raylike with age ....species of *Woodsia*

KEY 73

1. Veins mostly reticulate ...... *Lorinseria areolata*

1. Veins mostly free 2

2. Stipes densely covered with brownish hairs, without scales; indusia only the unmodified, green margins of the pinnules............... ....*Cheilanthes lanosa*

2. Stipes glabrous or with a few hairs; indusia laterally attached 3

3. Length of longest pinna usually less than 5 times its width; sori fewer than 15 per pinna.......... ....species of *Asplenium*

3. Length of longest pinna usually more than 3 times its width; sori usually more than 20 per pinna ... .species of *Athyrium*

KEY 74

1. Veins of leafy pinnae mostly reticulate, with only the outer ones free .... KEY 20

1. Veins of leafy pinnae mostly free, rarely a few reticulate along the midvein 2

2. Fronds strongly dimorphic, fertile and sterile blades on a common stipe; without sori on leafy blades ....KEY 31

2. Fronds not dimorphic or only slightly so; sori present on leafy blades 3

3. Blades 10 cm or more wide; middle pinnae usually more than 7 times as long as wide; stipes with 2 linear bundles at base; sori usually more than 20 per pinna .... *Athyrium pycnocarpon*

3. Blades 7 cm or less wide; middle pinnae usually less than 7 times as long as wide; stipes with 1 or 2 oval bundles at base; sori usually fewer than 15 per pinna ....species of *Asplenium* (except *A. montanum*)

KEY 75

1. Stipes without scales (except a few at base), with 3 bundles at extreme base, these united upward to 2 and then 1; indusia absent ....*Polypodium virginianum*

1. Stipes usually with scales, with 3 or more bundles at base and upward; indusia peltate or reniform 2

2. Pinnae or pinnules auriculate on one side at base; indusia peltate, circular, without a sinus . ...species of *Polystichum*

2. Pinnae or pinnules not auriculate; indusia reniform, often circular but with a sinus .... species of *Dryopteris* (except *D. marginalis*)

KEY 76

1. Sori linear, forming two rows along the midveins; veins mostly free but reticulate along the midveins .... *Woodwardia virginica*

1. Sori circular; veins all free 2

  2. Rachises with long hairs among the scales; stipes about ¼ or less as long as blade; basal pinnae ¼ or less as long as middle pinnae; indusia peltate, circular without a sinus .... *Polystichum braunii*

  2. Rachises glabrous or with short hairs; indusia reniform, sometimes appearing to be circular, but the sinus is usually evident.............. ....species of *Dryopteris*

KEY 77

1. Blades broadly triangular, 2/3 (or more) as wide as long; indusia absent ...... species of *Phegopteris*

1. Blades narrowly triangular to ovate, lanceolate, or elliptic 2

  2. Pinnae attached to rachis as broadly as their width; sori mostly 1 mm or more in diameter; indusia absent ....*Polypodium virginianum*

  2. Pinnae narrowly attached to rachis; sori 1 mm or less in diameter; indusia present, at least when young 3

3. Sori linear .... *Asplenium montanum*

3. Sori circular 4

  4. Stipe bundles free nearly to the blade; rachises without scales; indusia hoodlike.............. ....species of *Cystopteris*

  4. Stipe bundles soon united to 1 upward 5

5. Blades 8-20 cm wide; mature stipes without hairs or scales; indusia reniform, often circular but with a sinus .... *Thelypteris palustris*

5. Blades 1-5 cm wide, or if wider, then stipes hairy and scaly; indusia cuplike when young, raylike with age .... species of *Woodsia*

KEY 78

1. Fronds dimorphic or not, with sori on leafy blades; stipes slender, wiry, purplish or reddish......... ....*Pellaea atropurpurea*

1. Fronds strongly dimorphic, without sori on leafy blades; stipes mostly 2-5 mm in diameter 2

  2. Fertile and sterile blades separate but on a common stipe; stipe bundle not curled in at the ends; croziers not formed ....species of *Botrychium*

  2. Fertile and sterile blades on separate stipes or fertile and sterile pinnae on separate parts of the same blade; stipe bundle strongly curled in at the ends; croziers present on young plants ....species of *Osmunda*

KEY 79

1. Stipes densely covered with brownish hairs, without scales; indusia only the reflexed, unmodified, green margins of the pinnules ....*Cheilanthes lanosa*

1. Stipes glabrous or with hairs; indusia present or absent but not as reflexed margins 2

  2. Blades pinnatifid to pinnate ....*Polypodium virginianum*

  2. Blades pinnate-pinnatifid to tripinnate 3

3. Blades broadly triangular, 2/3 (or more) as wide as long; indusia absent ...... species of *Phegopteris*

3. Blades narrowly triangular to ovate, lanceolate, or elliptic 4

  4. Stipe bundles free nearly to the blade; rachises without scales; indusia hoodlike.............. ....species of *Cystopteris*

  4. Stipe bundles soon united to 1 upward 5

5. Blades 8-20 cm wide; mature stipes without hairs or scales; indusia reniform, often circular but with a sinus .... *Thelypteris palustris*

5. Blades 1-5 cm wide, or if wider then stipes hairy and scaly; indusia cuplike when young, raylike with age .... species of *Woodsia*

KEY 80

1. Blades ternate, each third triangular; stipe bundles free nearly to the blade....................... ....*Gymnocarpium dryopteris*

1. Blades not ternate .... KEY 79

KEY 81

1. Fertile and sterile blades separate, but on a common stipe 2

1. Fertile and sterile blades on separate stipes, or blades partly fertile and partly sterile 4

  2. Common stipes 0.5-6 cm long, much shorter than stalk of fertile blade; stalks of sterile blades more than 2 cm long .. *Botrychium dissectum*

  2. Common stipes 6-20 cm long, much longer than stalk of fertile blade; stalks of sterile blades less than 2 cm long 3

3. Stalks of sterile blades 0-0.6 cm long; stalks of fertile blades 0.5-1.5 cm long; sterile blades pinnate-pinnatifid or bipinnate .. *Botrychium lanceolatum*

3. Stalks of sterile blades 0.2-1.5 cm long; stalks of fertile blades 1-4 cm long; sterile blades pinnate or pinnate-pinnatifid ... *Botrychium matricariifolium*

4. Veins of sterile blades reticulate; fertile blades with spherical sori that resemble strings of beads .... *Onoclea sensibilis*

4. Veins of sterile blades not reticulate; sori not beadlike 5

5. Sterile blades with 5-11 pairs of pinnae..........
....KEY 16

5. Sterile blades with 15 or more pairs of pinnae ...
....6

6. Fertile and sterile pinnae much different, without sori on leafy pinnae 7

6. Fertile and sterile pinnae slightly different, sori borne on leafy pinnae 8

7. Fertile and sterile pinnae on separate fronds; stipes with scales, with 2 bundles at base; lowest pinnae very short, ¼ (or less) as long as middle pinnae..
.......................*Matteuccia struthiopteris*

7. Fertile and sterile pinnae on separate fronds or on separate parts of the same frond; stipes without scales, hairs may be present, with 1 bundle at base; lowest pinnae about ¾ (or more) as long as middle pinnae .... KEY 22

8. Stipes densely scaly; each pinna with an auricle, margins with bristle-tipped teeth; stipes with 4 or 5 bundles at base ....
..................*Polystichum acrostichoides*

8. Stipes with a few scales when young; pinnae without auricles; margins entire or shallowly toothed; stipes with 2 bundles at base 9

9. Stipes with 2 circular or oval bundles at base; lowest pair of pinnae equal to or slightly shorter than middle pinnae; veins forked, at least on sterile segments; sori circular .... *Thelypteris palustris*

9. Stipes with 2 linear, curved bundles at base; lowest pair of pinnae ¾ or less the length of middle pinnae and usually pointing downward; veins rarely forked; sori linear ...... *Athyrium thelypterioides*

KEY 82

1. Fertile and sterile blades separate but on a common stipe ....
species of *Botrychium* (except *B. lunaria* and *B. virginianum*)

1. Fertile and sterile blades on separate stipes or fertile and sterile pinnae on separate parts of the same blade 2

2. Fertile pinnae not leafy, much unlike sterile pinnae; stipe with 1 large, horseshoe-shaped bundle that is strongly curled in at the ends
........................species of *Osmunda*

2. Fertile pinnae leafy; stipe bundles 1 or 2, not curled in at the ends 3

3. Sterile blades with 12 or more pairs of pinnae; stipe with 2 bundles at base; sori circular and not marginal; indusia reniform, often circular but with a sinus .... *Thelypteris palustris*

3. Sterile blades with 5-11 pairs of pinnae; stipe with 1 bundle; indusia absent .... KEY 16

KEY 83

1. Fronds strongly dimorphic, without sori on leafy pinnules 2

1. Fronds not or slightly dimorphic, with sori on leafy pinnules .... KEY 36

2. Fertile and sterile blades separate, but on a common stipe; stipe bundle not curled in at the ends; croziers not formed ....
species of *Botrychium* (except *B. lunaria* and *B. virginianum*)

2. Fertile and sterile blades on separate stipes or fertile and sterile pinnae on separate parts of the same blade; stipe bundle curled in at the ends; croziers present on young plants ....
........................species of *Osmunda*

KEY 84

1. Fronds dimorphic, fertile and sterile blades separate, but on a common stipe; sori absent on leafy blades ....KEY 47

1. Fronds not dimorphic; sori borne on leafy blades
....2

2. Blades ternate, each third triangular; stipe bundles free nearly to the blade ....
..................*Gymnocarpium dryopteris*

2. Blades not ternate 3

3. Blades broadly triangular, mostly as wide or wider than long; rachises winged; indusia absent ....
.....................*Phegopteris hexagonoptera*

3. Blades narrowly triangular to ovate, lanceolate, or elliptic, usually longer than wide; indusia present, at least on young sori 4

4. Stipes densely covered with brownish hairs, without scales; indusia only the reflexed, unmodified, green margin of the pinnule .... *Cheilanthes lanosa*

4. Stipes glabrous or with a few hairs; true indusia present, at least on young sori 5

5. Sori circular 6

5. Sori linear 7

6. Stipe bundles free nearly to the blade; rachises without scales; veins of the pinnules extend to the margin; young indusia hoodlike, attached at one side .... species of *Cystopteris*

6. Stipe bundles soon united to 1 upward; veins do not reach the margin; young indusia cuplike, soon splitting into rays ...... *Woodsia obtusa*

7. Stipes without scales above the middle; mature blades 3-15 cm long, 2-7 cm wide, with 2-12 pairs of pinnae .... KEY 11

7. Stipes with scales; mature blades 30-60 cm long, 10-35 cm wide, with 15-40 pairs of pinnae....... .... *Athyrium filix-femina*

KEY 85

1. Blades ternate, each third triangular; stipe bundles free nearly to the blade...................... .... *Gymnocarpium dryopteris*

1. Blades not ternate 2

2. Blades broadly triangular, at least 2/3 as wide as long; rachises winged; indusia absent......... .... species of *Phegopteris*

2. Blades narrowly triangular or ovate or elliptic 3

3. Stipes densely covered with brownish hairs, without scales; indusia only the reflexed, unmodified, green margin of the pinnules .... *Cheilanthes lanosa*

3. Stipes glabrous or with hairs; true indusia present, at least on young sori 4

4. Indusia reniform, often circular but with a sinus, usually with tiny hairs or glands on the margin; blades 8-20 cm wide .... species of *Thelypteris*

4. Indusia not reniform 5

5. Stipe bundles separate nearly to the blade; rachises without scales; veins of pinnae extend to the margin; young indusia hoodlike, attached at one side .... species of *Cystopteris*

5. Stipe bundles unite to 1 upward; veins do not reach the margin; young indusia cuplike, soon splitting into rays .... species of *Woodsia*

KEY 86

1. Veins of leafy blades mostly reticulate, only the outer ones free .... KEY 20

1. Veins of leafy blades not reticulate 2

2. Fertile and sterile blades separate but from a common stipe .... species of *Botrychium*

2. Fertile and sterile blades on separate stipes or fertile and sterile pinnae on separate parts of the same blade 3

3. Fertile and sterile blades much different, without sori on leafy blades; fertile blades feather-like .... *Matteuccia struthiopteris*

3. Fertile and sterile blades slightly different, sori borne on leafy blades 4

4. Sori circular; indusia reniform, circular but with a sinus .... *Thelypteris palustris*

4. Sori linear; indusia laterally attached 5

5. Stipe bundles oval or short-linear; blades 2-7 cm wide; pinnae oblong, length less than 3 times the width; sori fewer than 15 per pinna............. .... *Asplenium platyneuron*

5. Stipe bundles long-linear; blades mostly 10-25 cm wide; pinnae linear-lanceolate, length more than 5 times the width; sori usually more than 20 per pinna 6

6. Blades pinnate, usually with 20-30 pairs of pinnae; rachises without scales .... *Athyrium pycnocarpon*

6. Blades pinnate-pinnatifid, usually with 15-20 pairs of pinnae; rachises with a few scales .... *Athryium thelypterioides*

KEY 87

1. First division of blade ternate each of the three divisions triangular; stipes with 2 bundles at base and upward .... *Gymnocarpium dryopteris*

1. Blades not ternate 2

2. Stipes densely scaly, with 3-9 bundles at base and upward; indusia reniform, often circular but with a sinus .... *Dryopteris marginalis*

2. Stipes with 1 or 2 bundles at base; indusia not reniform 3

3. Blades broadly triangular, at least 2/3 as wide as long; rachises winged ..... species of *Phegopteris*

3. Blades narrowly triangular to ovate, lanceolate, or elliptic 4

4. Stipes shorter than blade, without scales, with 1 large horseshoe-shaped bundle; pinnules with white, glandular hairs; indusia cuplike .... *Dennstaedtia punctilobula*

4. Stipes with 1 or 2 circular, oval, or short-linear bundles 5

5. Indusia of only the reflexed margins of the pinnules; stipes with 1 bundle (rarely 2) 6

5. Indusia present, at least on young sori; stipes with 2 bundles at base 7

6. Stipes and rachises densely covered with brownish hairs, without scales .... *Cheilanthes lanosa*

6. Stipes and rachises glabrous or with short, rough hairs .... KEY 35

7. Stipes with 2 bundles at base which remain separate nearly to the blade; rachises without scales; veins of pinnae extend to the margin; indusia hoodlike, attached at one side .... *Cystopteris fragilis*

7. Stipes with 2 bundles at base that soon unite upward; rachises with or without scales; veins do not reach the margin; young indusia cuplike when young, raylike with age ..... species of *Woodsia*

KEY 88

1. Stipes with 1 or 2 bundles at base 2

1. Stipes with 3-9 bundles at base and upward ... 3

2. Blades broadly triangular, mostly as wide or wider than long; rachises winged; indusia absent ....*Phegopteris hexagonoptera*

2. Blades narrowly triangular to ovate, lanceolate, or elliptic; indusia present, at least on young sori 4

3. Base of pinnule auriculate on the side facing upward; indusia peltate, circular without a sinus ....*Polystichum braunii*

3. Base of pinnule not auriculate; indusia reniform, often circular but with a sinus ....species of *Dryopteris* (except *D. marginalis*)

4. Stipe bundles free nearly to the blade or into the rachis; rachises without scales; veins of pinnules extend to the margin; indusia laterally attached, hoodlike .... species of *Cystopteris*

4. Stipe bundles soon united to 1 upward; indusia reniform, cuplike, or raylike 5

5. Mature stipes and rachises with hairs and scales; indusia cuplike when young, raylike with age ....*Woodsia obtusa*

5. Mature stipes mostly without hairs or scales above the middle; rachises without scales; indusia reniform, often circular but with a sinus ....species of *Thelypteris*

KEY 89

1. Blades broadly triangular, 2/3 (or more) as wide as long; indusia absent ...... species of *Phegopteris*

1. Blades narrowly triangular to ovate, lanceolate, or elliptic 2

2. Pinnae attached to rachis for their entire widths; sori (0.5-)1-2 mm in diameter; indusia absent .... *Polypodium virginianum*

2. Pinnae variously attached to rachis; sori 0.4-1 mm in diameter; indusia present, at least when young 3

3. Stipes with 1 or 2 bundles at base 4

3. Stipes with 3-9 bundles at base and upward ... 6

4. Stipe bundles free nearly to blade; blades 4-15 cm wide; rachises without scales; indusia hoodlike .... species of *Cystopteris*

4. Stipe bundles soon united to 1 upward 5

5. Mature blades 1-5 cm wide; indusia cuplike when young, raylike with age ..... species of *Woodsia*

5. Mature blades 8-20 cm wide; indusia reniform, often circular but with a sinus ....species of *Thelypteris*

6. Mature blades less than 6 cm wide; stipe about ¼ as long as blade; basal pinnae ¼-⅓ as long as middle pinnae .... *Dryopteris fragrans*

6. Mature blades more than 6 cm wide 7

7. Blades 20-50 cm wide; stipe ¾ to as long as blade; basal pinnae usually shaped like those above, and about same length as middle pinnae ....*Dryopteris goldiana*

7. Blades 6-20 cm wide; stipes ¼ to as long as blade; basal pinnae usually shorter than those above and broader at base, being somewhat triangular ... 8

8. Fertile fronds usually taller and more erect than sterile fronds; blades 6-18 cm wide; basal pinnae usually broadly triangular and shorter than middle pinnae .... *Dryopteris cristata*

8. Fertile and sterile fronds alike; blades 10-30 cm wide; basal pinnae usually narrowly triangular and slightly shorter or equal to middle pinnae ....*Dryopteris clintoniana*

KEY 90

1. Fronds strongly dimorphic with fertile and sterile blades on a common stipe; without sori on leafy blades .... species of *Botrychium* (except *B. lunaria* and *B. virginianum*)

1. Fronds not dimorphic or only slightly so; sori borne on leafy blades 2

   2. Blades broadly triangular, mostly as wide or wider than long, rachises winged; indusia absent .... *Phegopteris hexagonoptera*

   2. Blades narrowly triangular to ovate, lanceolate, or elliptic; indusia present, at least on young sori 3

3. Stipe bundles remain separate nearly to the blade or into the rachis; rachises without scales; veins of pinnules extend to the margin; sori circular...... ....species of *Cystopteris*

3. Stipe bundles soon united to 1 upward 4

   4. Blades 1-6 cm wide 5

   4. Blades 6-20 cm wide 6

5. Pinnae 7-23 pairs, sessile on the rachis; sori circular .... KEY 26

5. Pinnae 2-12 pairs, with stalks; sori linear ....KEY 11

   6. Stipe bundles at base usually about three times as long as wide; sori linear, curved ....*Athyrium filix-femina*

   6. Stipe bundles at base usually not more than twice as long as wide; sori circular 7

7. Blades pinnate-pinnatifid to nearly bipinnate; stipes glabrous or with a few hairs, without scales above the middle; rachises without scales; indusia reniform, often circular but with a sinus ....species of *Thelypteris*

7. Blades pinnate-bipinnatifid to bipinnate-pinnatifid; stipes and rachises with hairs and scales; indusia cuplike when young, raylike with age ....*Woodsia obtusa*

KEY 91

1. Veins of leafy blades mostly reticulate, only the outer ones free .... *Onoclea sensibilis*

1. Veins of leafy blades mostly not reticulate ... 2

   2. Fronds strongly dimorphic, sterile and fertile blades much different 3

   2. Fronds not dimorphic or only slightly so ..6

3. Sterile and fertile blades on separate stipes; leafy blades more than 40 cm long.................. ....*Matteuccia struthiopteris*

3. Sterile and fertile blades on a common stipe; leafy blades less than 10 cm long 4

   4. Common stipe much shorter than stalk of fertile blade; stalk of sterile blade more than 2 cm long .... *Botrychium dissectum*

   4. Common stipe much longer than stalk of fertile blade; stalk of sterile blade less than 2 cm long 5

5. Stalk of sterile blade 0-0.6 cm long; stalk of fertile blade 0.5-1.3 cm long; sterile blade pinnate-pinnatifid or bipinnate ....*Botrychium lanceolatum*

5. Stalk of sterile blade 0.2-1.5 cm long; stalk of fertile blade 1-4 cm long; sterile blade pinnate or pinnate-pinnatifid .... *Botrychium matricariifolium*

   6. Blades broadly triangular, ⅔ (or more) as wide as long; rachises winged; sori circular; indusia absent ...... species of *Phegopteris*

   6. Blades narrowly triangular to ovate, lanceolate, or elliptic; indusia present on fertile blades 7

7. Stipe bundles separate nearly to the blade or into the rachis; rachises without scales; sori circular; indusia hoodlike, attached at one side ....species of *Cystopteris*

7. Stipe bundles united to 1 below the middle of the stipe 8

   8. Mature blades up to 7 cm wide 9

   8. Mature blades more than 7 cm wide ... 10

9. Pinnae sessile or nearly so; sori circular ....species of *Woodsia*

9. Pinnae stalked; sori linear. .*Asplenium montanum*

   10. Lowest pair of pinnae much shorter than middle pinnae 11

   10. Lowest pair of pinnae nearly as long as middle pinnae 12

11. Stipe about ½ to ¾ as long as blade; rachis with hairs and a few scales; sori linear.............. ....*Athyrium thelypterioides*

11. Stipe about ¼ as long as blade; rachis glabrous or with a few hairs, without scales; sori circular ....*Thelypteris noveboracensis*

   12. Veins of sterile pinnae mostly forked; young fertile fronds with partially inrolled margins; indusia ciliate .... *Thelypteris palustris*

   12. Veins of sterile pinnae not forked; fertile fronds with flat margins; indusia with tiny glands .... *Thelypteris simulata*

KEYS TO SPECIES WHEN GENUS IS KNOWN

ADIANTUM

One species in our area .... *A. pedatum*

ASPLENIUM

1. Blades pinnate 2
1. Blades pinnate-pinnatifid to bipinnate-pinnatifid, at least lower part of blade; rachis green..........4
    2. Basal pinnae shorter than middle pinnae, usually less than ½ as long; basal lobes overlapping the rachis .... *A. platyneuron*
    2. Basal pinnae about same length or longer than middle pinnae, rarely only ¾ as long; basal lobes not overlapping the rachis 3
3. Rachises and stipes dark brown, without hairs or scales .... *A. trichomanes*
3. Rachises and upper part of stipe light green, with hairlike scales .... *A. viride*
    4. Stipes green throughout, slender; blades with 2-6 pairs of pinnae; veins of pinnules fanlike.. ....*A. ruta-muraria*
    4. Stipes brown at base, green above; blades with 5-12 pairs of pinnae; veins obscure........... ....*A. montanum*

ATHYRIUM

1. Blades bipinnate to tripinnate; sori curved, often hooked at one end .... *A. filix-femina*
1. Blades pinnate or pinnate-pinnatifid; sori straight or nearly so 2
    2. Blades pinnate; rachises without scales ....*A. pycnocarpon*
    2. Blades pinnate-pinnatifid; young rachises with narrow scales .... *A. thelypterioides*

AZOLLA

One species in our area .... *A. caroliniana*

BOTRYCHIUM

1. Stalks of sterile blades 0-1.5 cm long 2
1. Stalks of sterile blades 2.5-15 cm long 7
    2. Sterile blades sessile, bipinnate-pinnatifid to nearly tripinnate .... *B. virginianum*
    2. Sterile blades pinnatifid to bipinnate 3
3. Sterile blades attached below the middle of the frond; lowest pinnae about as wide as long 4
3. Sterile blades attached above the middle of the frond 5
    4. Sterile blades sessile or with stalks less than 1/5 as long as blades, with 3-10 pairs of pinnae that are at a right-angle to the rachis .... *B. lunaria*
    4. Sterile blades with stalks ⅓ to ½ as long as blades, with 1-5 pairs of pinnae that usually are oblique to the rachis .... *B. simplex*
5. Sterile blades sessile or nearly so ....*B. lanceolatum*
5. Sterile blades with stalks 6
    6. Pinnae of sterile blades lobed or pinnatifid; basal pinnae longer than wide................. ....*B. matricariifolium*
    6. Pinnae of sterile blades obovate, not or scarcely lobed; basal pinnae about as wide as long ....*B. simplex*
7. Pinnule lobes or segments of sterile blades obtuse, about as long as wide .... *B. oneidense*
7. Pinnule lobes or segments of sterile blades acute or obtuse, 2-5 times as long as wide 8
    8. Sterile blades thin, membranous or slightly leathery, often lacelike in appearance; pinnule segments variable in size and shape but usually more than twice (often 4 or 5 times) as long as wide with ultimate lobes or teeth somewhat parallel-sided and mostly acute at apex ....*B. dissectum*
    8. Sterile blades thick, leathery or fleshy; pinnule segments of similar size and shape and mostly not more than twice (rarely 3 times) as long as wide with ultimate lobes or teeth not parallel-sided and mostly obtuse at apex ....*B. multifidum*

CAMPTOSORUS

One species in our area .... *C. rhizophyllus*

CHEILANTHES

One species in our area .... *C. lanosa*

CRYPTOGRAMMA

One species in our area .... *C. stelleri*

CYSTOPTERIS

1. Blades narrowly triangular to linear-lanceolate, long-tapering to apex; pinnae 20-40 pairs; basal pinnae slightly longer than next pair above; veins mostly running to the sinuses between marginal teeth; rachises often with bulblets .. C. *bulbifera*
1. Blades variable, but usually ovate to ovate-lanceolate, not long-tapering to apex; pinnae 9-15 pairs; basal pinnae slightly shorter than next pair above; veins mostly running to the marginal teeth; rachises never with bulblets .... C. *fragilis*

DENNSTAEDTIA

One species in our area .... D. *punctilobula*

DRYOPTERIS

(Apparently any of our species of *Dryopteris* may hybridize with other species of the genus, forming sterile or fertile hybrids. This key separates only those recognized as distinct species. The user should be aware that intermediates occur.)

1. Mature blades less than 6 cm wide; stipe about ¼ as long as blade; basal pinnae ¼-½ as long as middle pinnae .... D. *fragrans*
1. Mature blades more than 6 cm wide 2
    2. Sori marginal or nearly so; pinnule margins with obscure teeth with no bristle at tip ....D. *marginalis*
    2. Sori not marginal; pinnule margins having teeth with a bristle at tip 3
3. Blades pinnate-pinnatifid to nearly bipinnate-pinnatifid; basal pinnae nearly equal-sided; teeth tipped with very short bristle 4
3. Blades bipinnate-pinnatifid to tripinnate-pinnatifid; basal pinnae strongly unequal-sided; teeth ending in long bristle 6
    4. Blades 20-50 cm wide; stipe ¾ to as long as blade; basal pinnae usually shaped like those above and about same length as middle pinnae ....D. *goldiana*
    4. Blades 6-30 cm wide; stipe ¼ to as long as blade; basal pinnae usually shorter than those above and broader at base, being somewhat triangular 5
5. Fertile fronds usually taller and more erect than sterile fronds; blades 6-18 cm wide; basal pinnae usually broadly triangular and shorter than middle pinnae .... D. *cristata*
5. Fertile and sterile fronds alike; blades 10-30 cm wide; basal pinnae usually narrowly triangular and slightly shorter or equal to middle pinnae ....D. *clintoniana*
    6. Lowest basal pinnule on lower side of lowest pinna shorter than pinnule closest to it; hairs present on stipe, rachis, and indusia ....D. *intermedia*
    6. Lowest basal pinnule on lower side of lowest pinna longer than pinnule closest to it; fronds without hairs 7
7. Basal pair of pinnules of lowest pinna opposite or nearly so (4 mm or less apart); the pinnule closest to the rachis on the lower side of the lowest pinna about twice as long and slightly wider at base than the opposing pinnule .... D. *spinulosa*
7. Basal pair of pinnules of lowest pinna alternate (4 mm or more apart); the pinnule closest to the rachis on the lower side of the lowest pinna two or three times as long and much wider than the opposing pinnule .... D. *campyloptera*

GYMNOCARPIUM

One species in our area .... G. *dryopteris*

LORINSERIA

One species in our area .... L. *areolata*

LYGODIUM

One species in our area .... L. *palmatum*

MARSILEA

One species in our area .... M. *quadrifolia*

MATTEUCCIA

One species in our area .... M. *struthiopteris*

ONOCLEA

One species in our area .... O. *sensibilis*

OPHIOGLOSSUM

One species in our area .... O. *vulgatum*

OSMUNDA

1. Blades bipinnate; pinnule margins serrulate; pinnae stalked; fertile pinnae above sterile pinnae on same blade .... O. *regalis*
1. Blades pinnate-pinnatifid; pinnule margins entire; pinnae sessile; fertile pinnae between sterile pinnae on same blade or on separate blades 2
    2. Fertile and sterile pinnae on separate blades; sterile pinnae (when young) with a tuft of hairs at base .... O. *cinnamomea*
    2. Fertile and sterile pinnae on the same blade; sterile pinnae without tuft of hairs ....O. *claytoniana*

PELLAEA

1. Fronds usually dimorphic; stipes and rachises with rough appressed hairs; blades grayish green; stalks of lowest pair of pinnae 1-10 mm long .... *P. atropurpurea*

1. Fronds not strongly dimorphic; stipes and rachises glabrous or with a few spreading hairs; blades bluish green; stalks of lowest pair of pinnae 0-3 mm long .... *P. glabella*

PHEGOPTERIS

1. Lowest pair of pinnae longer than the pair next above, and joined to it at the winged rachis; blades mostly as wide or wider than long; rachises with a few scales .... *P. hexagonoptera*

1. Lowest pair of pinnae shorter than the pair next above and not joined to it; blades not as wide as long; rachises with many scales ... *P. connectilis*

PHYLLITIS

One species in our area .... *P. scolopendrium*

POLYPODIUM

One species in our area .... *P. virginianum*

POLYSTICHUM

1. Blades mostly pinnate; lowest pinnae nearly as long as middle pinnae .... *P. acrostichoides*

1. Blades mostly bipinnate; lowest pinnae much shorter than middle pinnae .... *P. braunii*

PTERIDIUM

One species in our area .... *P. aquilinum*

SCHIZAEA

One species in our area .... *S. pusilla*

THELYPTERIS

1. Blades much narrowed at base; lowest pinnae much shorter than middle pinnae............... .... *T. noveboracensis*

1. Blades scarcely narrowed at base; lowest pinnae about as long as middle pinnae 2

    2. Veins of sterile pinnae mostly forked; young fertile fronds with inrolled margins; indusia ciliate .... *T. palustris*

    2. Veins of sterile pinnae not forked; fertile fronds with flat margins; indusia with tiny glands .... *T. simulata*

WOODSIA

1. Blades 7 cm wide or more .... *W. obtusa*

1. Blades less than 7 cm wide 2

    2. Blades 3-7 cm wide 3

    2. Blades less than 3 cm wide 4

3. Stipes and rachises with many hairs and scales; stipe with a joint at or below the middle (old stipe bases rather uniform in length); indusia with many hairlike rays ....*W. ilvensis*

3. Stipes and rachises with a few hairs and scales; stipes not jointed (old stipe bases uneven in length); indusia with 3-6 short, scalelike rays..... ....*W. obtusa*

    4. Stipes and rachises without hairs or scales ... . *W. glabella*

    4. Stipes and rachises with hairs and scales ... 5

5. Blades with a few hairs; midveins of pinnae with no or few scales; pinnae mostly with 2 or 3 pairs of pinnules or pinna segments .... *W. alpina*

5. Blades with many hairs; midveins of pinnae scaly; pinnae mostly with 4 or more pairs of pinnules or pinna segments .... *W. ilvensis*

WOODWARDIA

One species in our area .... *W. virginica*

DESCRIPTIONS OF SPECIES

Adiantum pedatum Linnaeus Plate 1

MAIDENHAIR FERN

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Rich, moist, deciduous woods. Soil variable but plants appear to be more luxuriant at low acidity.

RHIZOMES woody, branched, 1-5 mm in diameter, scaly. CROZIERS clustered, reddish. FRONDS not dimorphic, coming separately but near together from points on the rhizome, mostly 20-60 cm long, not evergreen. STIPE wiry, usually a little longer than the blade, 1-3 mm wide, shiny black or brown, glabrous, often with a few scales at base, with 1 horseshoe-shaped bundle. BLADES circular or semicircular, fanlike, 12-20(-25) cm long, 20-30(-40) cm wide; rachis forked forming two nearly equal parts of the blade, each part bipinnate. PINNAE alternate, usually 10-14 (not paired), oblong, 4-17 cm long, about 4 cm wide. PINNULES 12-20 on a pinna, alternate, oblong, 1-2 cm long, 0.6-1 cm wide, glabrous; margins entire but wavy or lobed on one side. VEINS palmate, many per pinnule, forked two or three times. SORI marginal, linear. INDUSIA oblong, 2-5 mm long, being the reflexed margin of the pinnule. SPORES tetrahedral.

Adiantum capillus-veneris, SOUTHERN MAIDENHAIR FERN, ranging as far north as Virginia and Kentucky, is sometimes reported for our area but it probably does not persist.

Asplenium montanum Willdenow Plate 2

MOUNTAIN SPLEENWORT

A. bradleyi in part (which is probably a hybrid of *A. m.* and *A. platyneuron*).

NY (rare), Vt (rare), Mass (rare), Ct (rare), RI (rare), NJ, Pa.

Moist, protected, shady crevices in sandstone and other non-calcareous rocks. Soil acid, pH mostly 4-6.

RHIZOMES short, creeping, about 1 mm in diameter, scaly. FRONDS not dimorphic, clustered, 5-20 cm long, evergreen. STIPE shorter than, or about same length as blade, 2-10 cm long, brown at base, green above, not scaly, with 2 oval bundles at extreme base, united just above to form 1 nearly circular bundle. BLADES deltoid-ovate to ovate-lanceolate, 5-10 (-15) cm long, 3-6 (-7) cm wide, pinnate-pinnatifid to bipinnate-pinnatifid; rachis green, flattened. PINNAE alternate or subopposite, 5-12 pairs, ovate-oblong, stalked, lowest pair longest. PINNULES of various shapes and dissections; margins serrate. VEINS obscure, free, forked or not, not reaching the margin. SORI few, linear, separate or some confluent, not marginal. INDUSIA fragile, laterally attached. SPORES bilateral.

Resembles a blend of *Asplenium ruta-muraria* and *Cystopteris fragilis*.

Asplenium pinnatifidum Nuttall, LOBED SPLEENWORT, a southern species found as far north as New Jersey and Pennsylvania, resembles a blend of *A. montanum* and *Camptosorus rhizophyllus* and may have originated as a hybrid of these two species. It has also been called *Camptosorus pinnatifidus* and × *Asplenosorus pinnatifidus*.

Asplenium platyneuron (Linnaeus) Oakes Plate 3

EBONY SPLEENWORT

A. bradleyi, in part (which is probably a hybrid of *A. p.* and *A. montanum*).

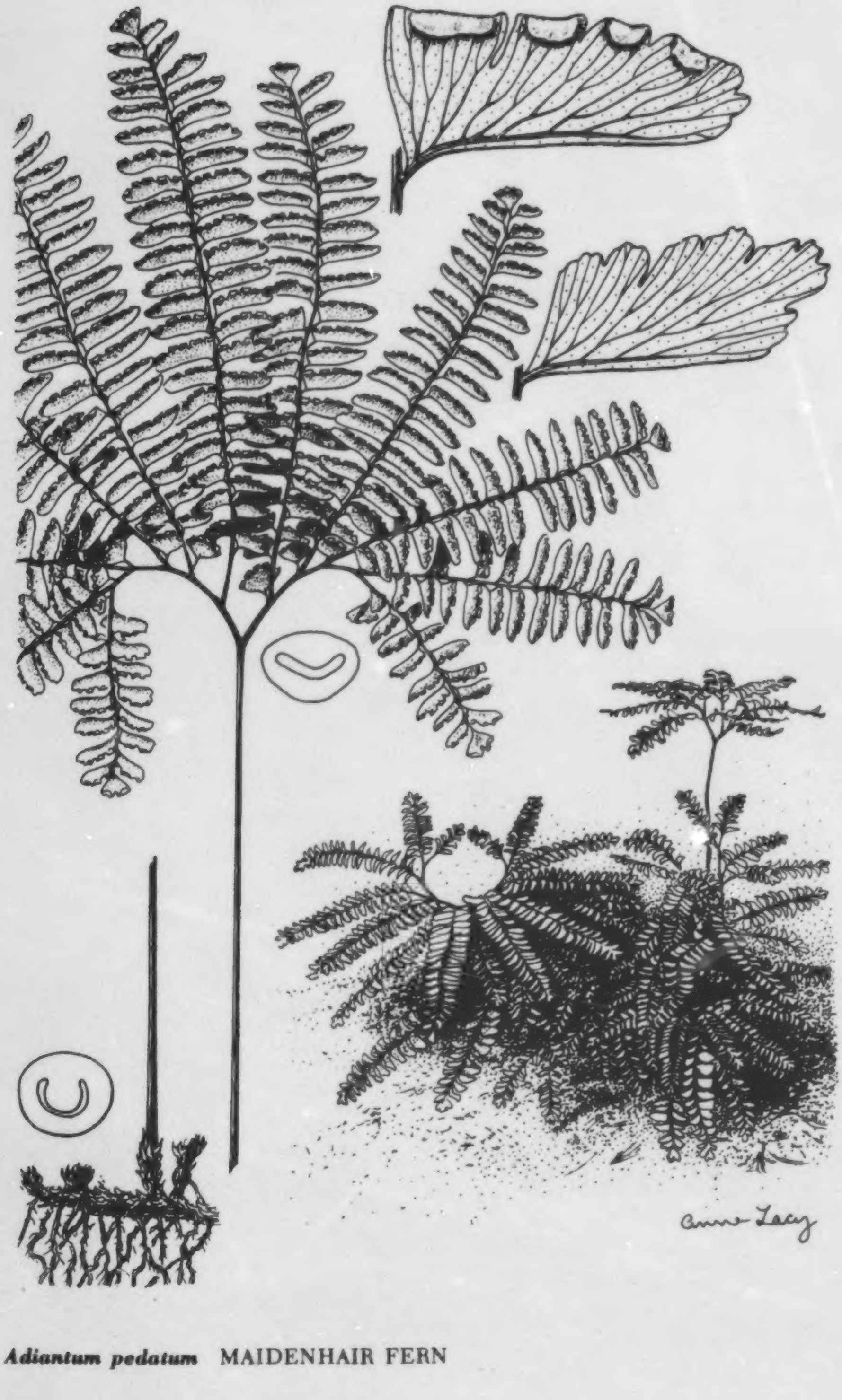
NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Crevices in cliffs and shady rocky slopes, sometimes on hummocks in swamps or on sand. Soil variable as to pH; does best in acid soil but often found on cement.

RHIZOMES short, creeping or ascending, 2.5-3.5 mm in diameter, with a few scales. FRONDS dimorphic in that fertile fronds are longer than sterile fronds, clustered, (5-)15-50(-60) cm long, evergreen. STIPE much shorter than blade, dark brown, shiny, often with a few hairs or scales with 1 or 2 circular or oval bundles at base, sometimes V-shaped or X-shaped upward. BLADES linear-lanceolate to narrowly elliptic-lanceolate, mostly 10-35 cm long, 2-7 cm wide, pinnate; rachis dark brown, shiny, with scales. PINNAE alternate, 15-25 pairs on sterile blades, 30-50 pairs on fertile blades, mostly oblong, auriculate, the auricles overlapping the rachis, sessile, lowest pair much shorter than middle ones; margins usually serrate or crenate. VEINS free, mostly once-forked, not reaching the margin. SORI short-linear, straight, 8-12 per pinna, often confluent in age, not marginal. INDUSIA fragile, silvery when young, withering in age, laterally attached. SPORES bilateral.

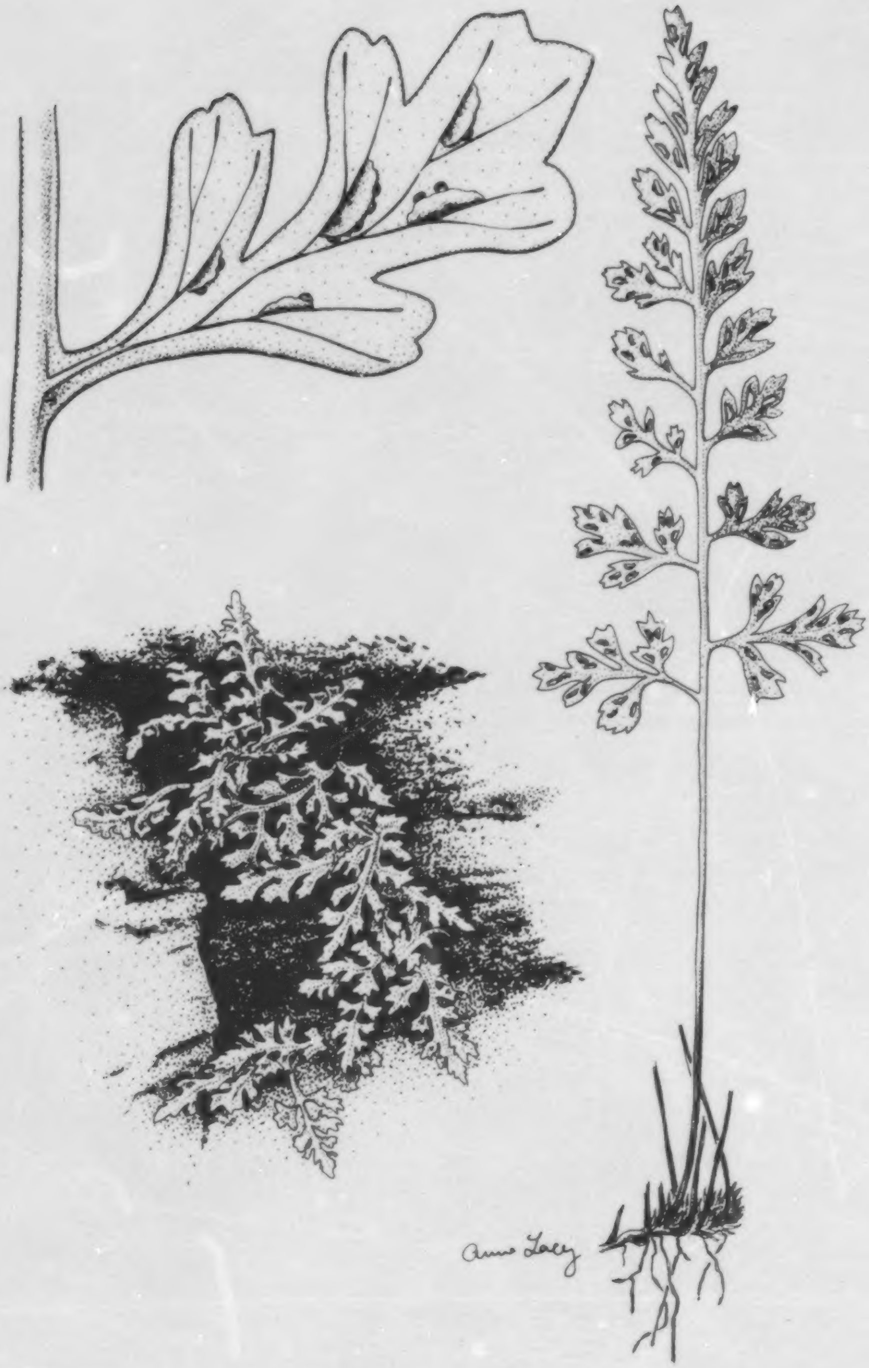
Asplenium resiliens Kunze, BLACKSTEM SPLEENWORT, has been found in Pennsylvania where it may now be extinct. Similar to *A. platyneuron* it differs in having the pinnae mostly opposite with a cuneate base, sterile fronds about the same length as the fertile fronds, with a nearly black rachis.

Plate 1

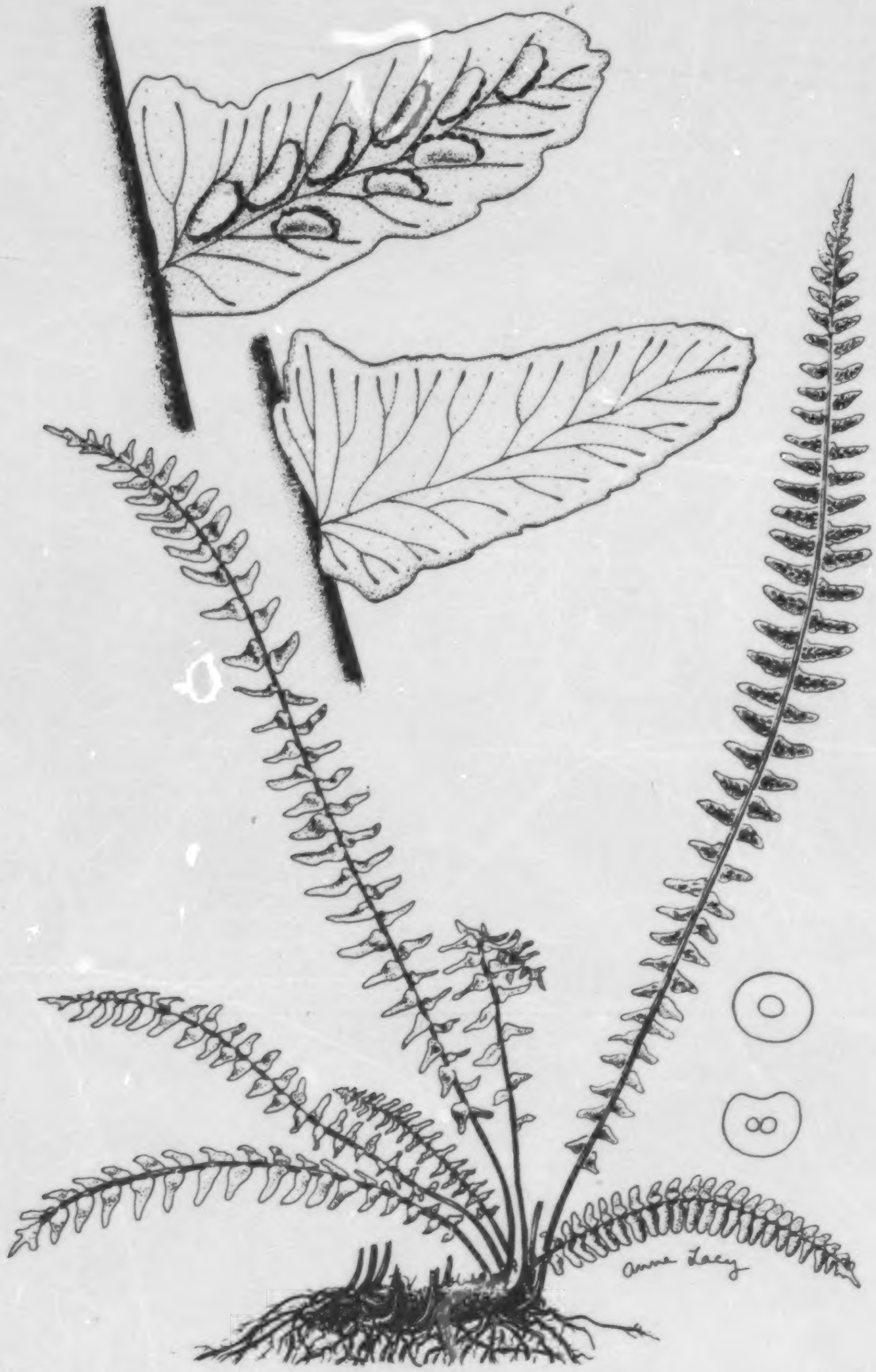


Adiantum pedatum MAIDENHAIR FERN

Plate 2



Asplenium montanum MOUNTAIN SPLEENWORT



Asplenium platyneuron EBONY SPLEENWORT

A. platyneuron × *A. trichomanes* and *A. platyneuron* × *Camptosorus rhizophyllus* may be looked for, especially where their parents are found together. They combine the characters of the parent species.

Asplenium ruta-muraria Linnaeus Plate 4

WALL RUE, WALL RUE SPLEENWORT

A. cryptolepis

NY, Vt, Mass, Ct, NJ, Pa.

Limestone rocks and cliffs, calcareous shale, sometimes on cement. Soil neutral to alkaline, pH 7-9.

RHIZOMES short, creeping, 1-1.5 mm in diameter, scales hidden in the roots, with persistent old stipe bases. FRONDS not dimorphic, clustered, 4-17 cm long, evergreen. STIPE longer or shorter than blade, 1.5-7 cm long, green throughout, with a few scales at base, with 2 circular or oval bundles at base, soon united above to form 1 bundle. BLADES ovate or triangular-ovate, (1-)3-6(-12) cm long, 2-4 cm wide, bipinnate to bipinnate-pinnatifid (at least the lower part); rachis green, flattened. PINNAE alternate, 2-6 pairs, broad-ovate or fanlike, stalked, lowest pair usually longest. PINNULES of various shapes and dissections but often fanlike; margins often serrulate. VEINS mostly free, sometimes a few reticulate, forked or fanlike. SORI few, 2-4 per segment, linear or oblong, separate when young, becoming confluent in age, not marginal. INDUSIA broad, laterally attached, with a few hairs. SPORES bilateral.

Withering when dry but recovering in moisture.

Asplenium trichomanes Linnaeus Plate 5

MAIDENHAIR SPLEENWORT

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Crevices and other places in rocks of various kinds, moist or dry, open or shaded. Soil acid, pH mostly 5-7.

RHIZOMES short, creeping to erect, 1.5-2 mm in diameter, with many old stipe bases, with scales at the apex. FRONDS not dimorphic, densely clustered, 4-26 cm long, evergreen. STIPE shorter than blade, wiry, purple-brown, shining, sometimes with a few scales, with 1 or 2 circular or oval bundles at base. BLADES linear, 5-20 cm long, 0.8-1.7 cm wide, pinnate; rachis dark. PINNAE opposite or alternate, 9-30 pairs, oval to broad-oblong, unequal-sided but not auriculate, sessile, lowest pair about same length as middle ones; margins crenate or nearly entire. VEINS free, mostly once-forked, not reaching the margin. SORI short, linear, straight, 2-4(-6) per pinna, mostly separate, not marginal. INDUSIA large but fragile, laterally attached. SPORES bilateral.

Asplenium viride Hudson Plate 6

GREEN SPLEENWORT

NY (rare), Vt (rare), Me (rare).

Shaded crevices and among fragments of limy rock. Soil nearly neutral.

RHIZOMES short, creeping to erect, about 1 mm in diameter, with a few scales. FRONDS not dimorphic, clustered, 5-15 cm long, usually evergreen. STIPE shorter than the blade, slender, brown at base, green above, usually with a few scales, with 1 or 2 circular or oval bundles at base. BLADES linear to linear-oblong, mostly 6-13 cm long, 0.5-1.5 cm wide, pinnate; rachis delicate, green, usually with dark hairlike scales. PINNAE opposite or nearly so toward base of blades, alternate above, 9-16 pairs, oval, not auriculate; margins coarsely toothed or lobed. VEINS free, simple or forked, not reaching the margin. SORI linear, straight, 2 or 3 per pinna, confluent, not marginal. INDUSIA fragile, laterally attached. SPORES bilateral.

Athyrium filix-femina (Linnaeus) Roth Plate 7

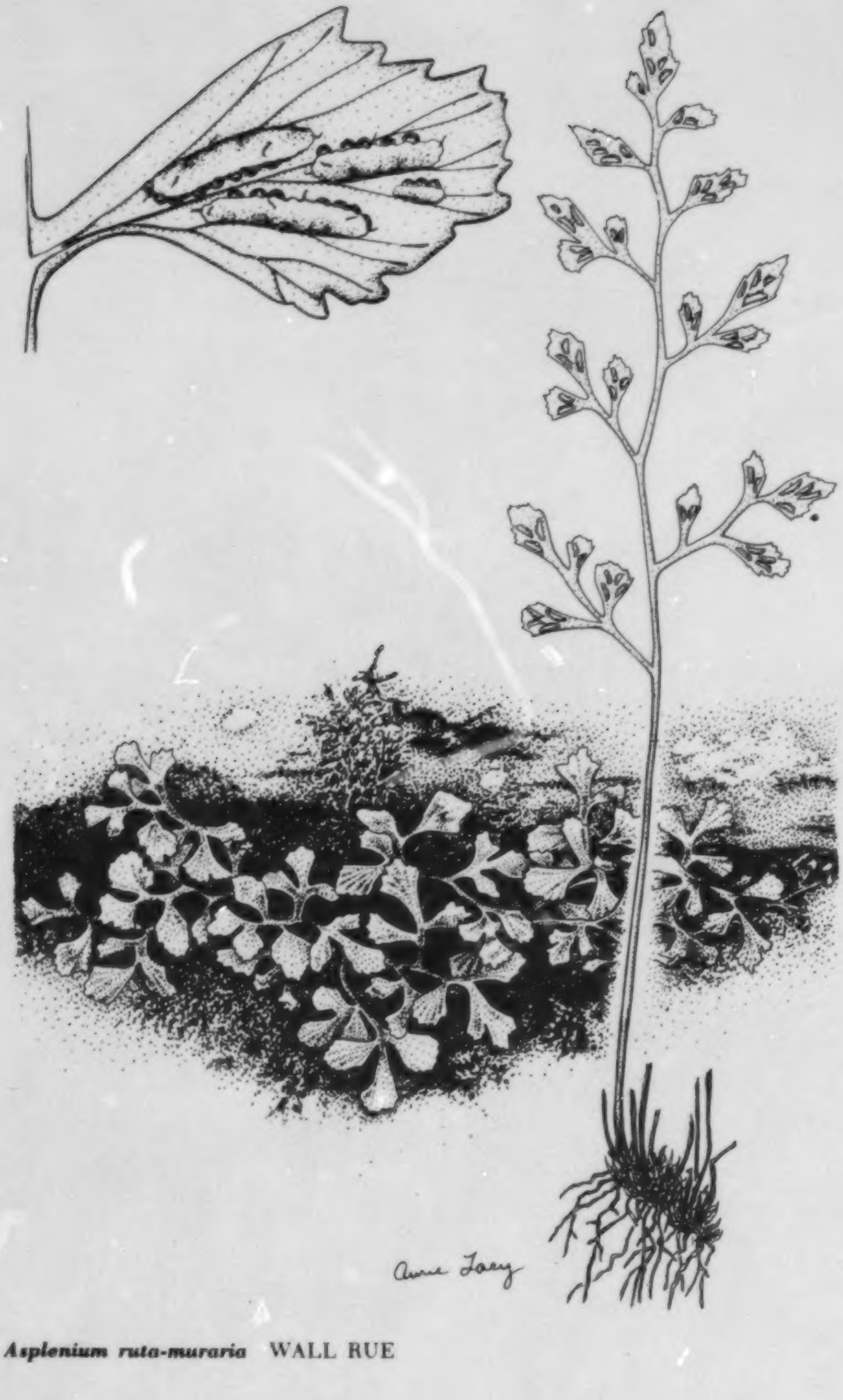
LADY FERN

A. angustum, *A. asplenioides*

NY, Vt, NH, Me, Mass, Ct, RI NJ, Pa.

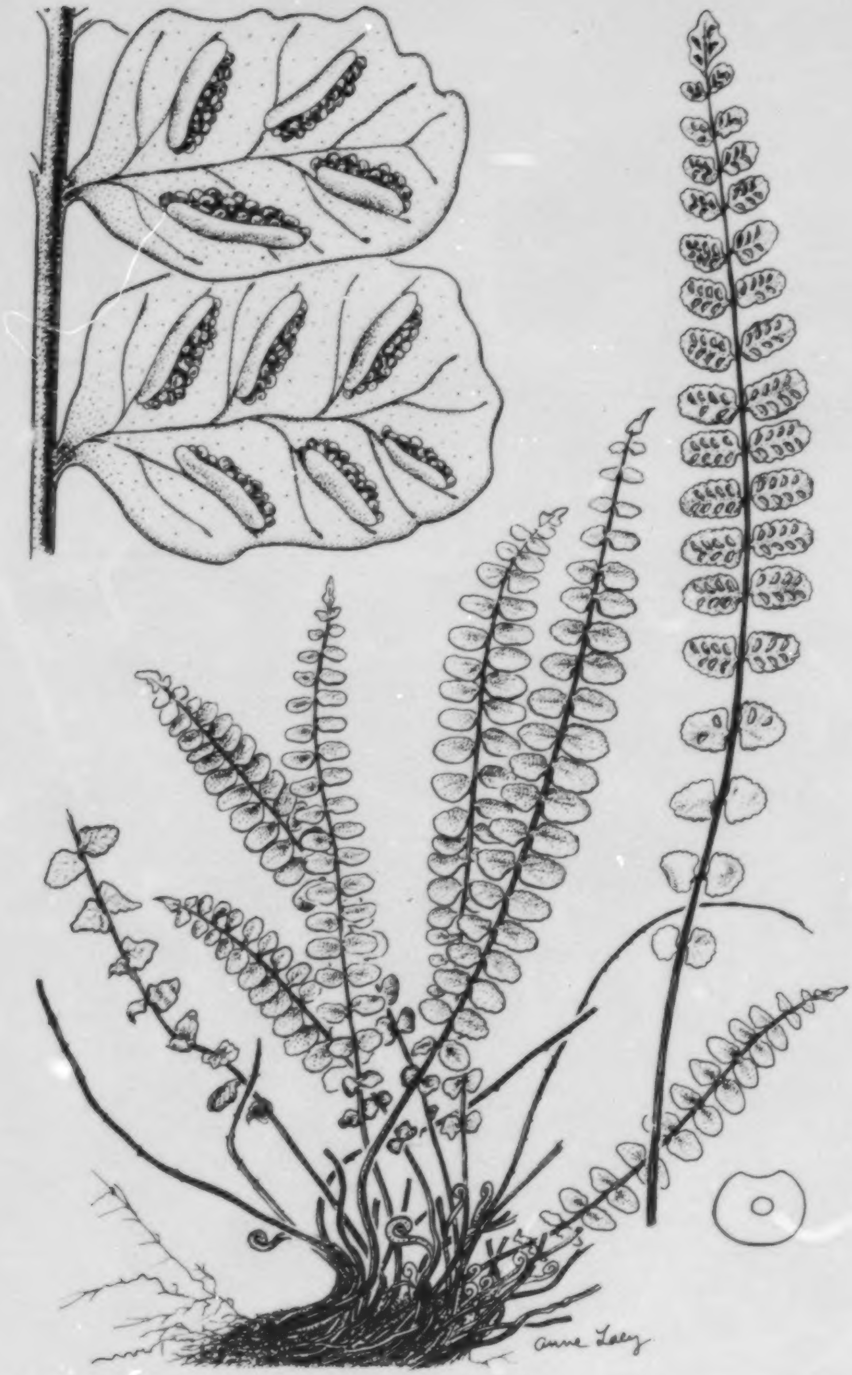
Moist woods, meadows, stream banks, marshes, etc. Soil acid to neutral, pH 5-7.

RHIZOMES creeping to nearly erect, about 7 mm in diameter, scaly. CROZIERS round-oblong, 1-2 cm in diameter, densely covered with linear, dark brown or purple scales. FRONDS not dimorphic, coming separately (but near together) from points on the rhizome, (7-)40-90(-100) cm long, not evergreen. STIPE ½ to nearly as long as blade, greenish or reddish, 1-40 cm long, to 6 mm wide, without hairs, with dark brown or purple scales, with 2 curved bundles at base, sometimes united upward. BLADES oblong to lanceolate or ovate-lanceolate, (5-)30-45(-60) cm long, 10-20 (-35) cm wide, bipinnate to bipinnate-pinnatifid (rarely tripinnate); rachis glabrous or with short hairs or scales, green. PINNAE (15-)30-40 pairs, mostly alternate, oblong-lanceolate, with a very short stalk, longest 3-15 cm long, usually 1-4 cm wide, lower pinnae shorter or longer than middle pinnae. PINNULES mostly 20-30 pairs, mostly alternate but often opposite at base, oblong, usually glabrous; margins lobed or toothed. VEINS free, forked, reaching the margin. SORI not marginal, linear, straight or curved, usually hooked at one end, usually 3-10 per segment, separate or semi-confluent with age. INDUSIA laterally attached, ciliate, sometimes glandular. SPORES bilateral.



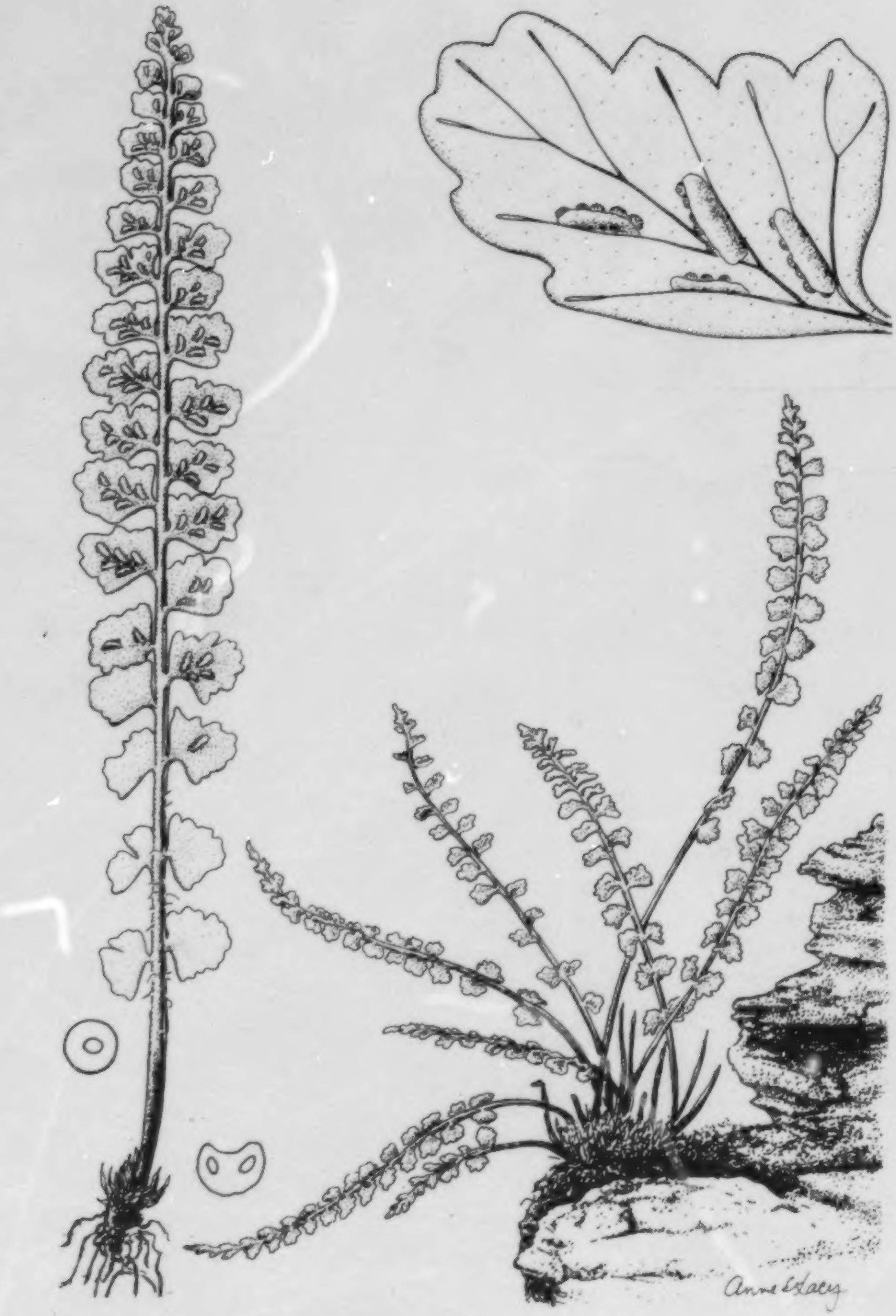
Asplenium ruta-muraria WALL RUE

Plate 5

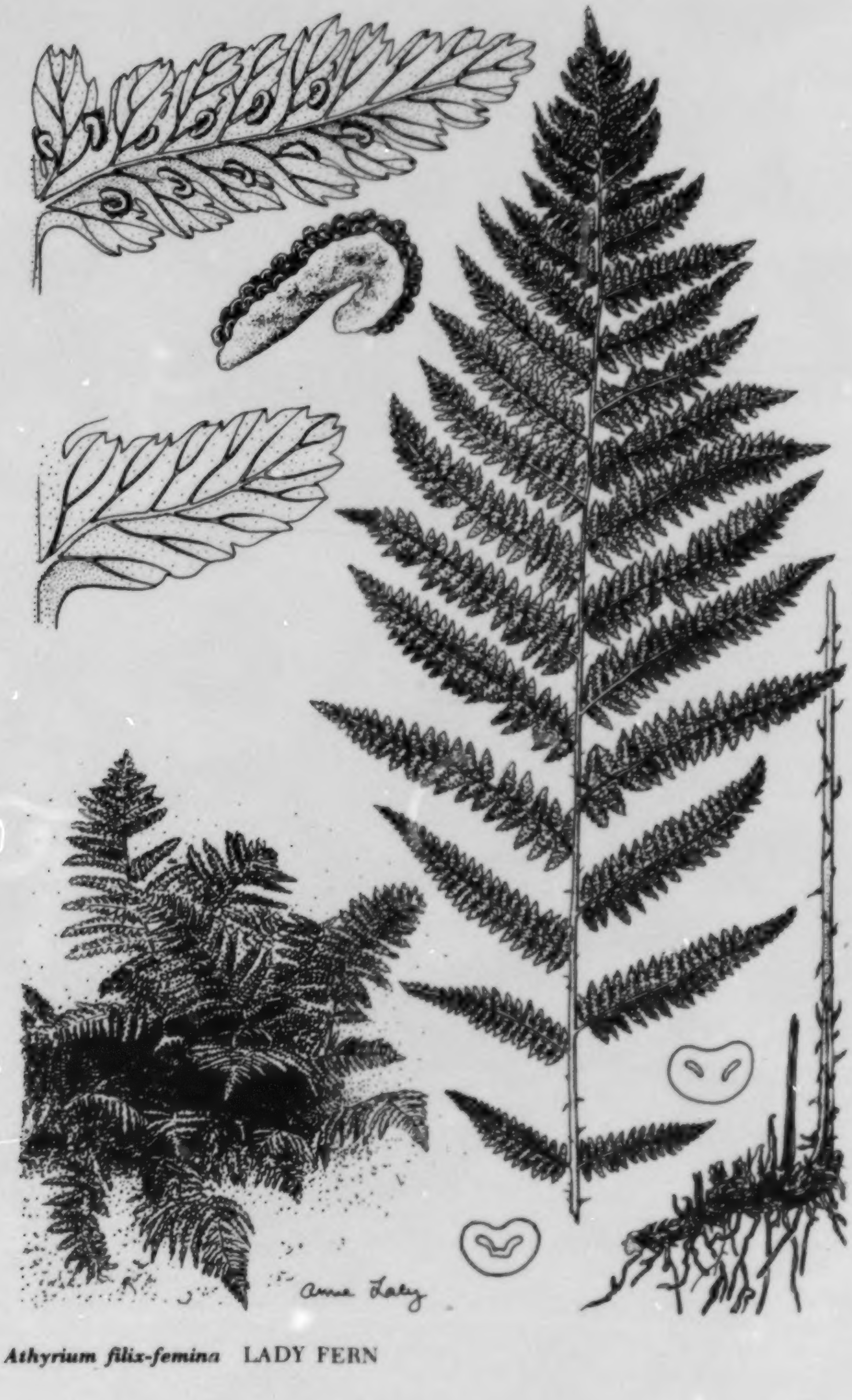


Asplenium trichomanes MAIDENHAIR SPLEENWORT

Plate 6



Asplenium viride GREEN SPLEENWORT



Athyrium filix-femina LADY FERN

Athyrium pycnocarpon (Sprengel) Tidestrom Plate 8

GLADE FERN, NARROW-LEAVED SPLEENWORT

Diplazium pycnocarpon

NY, Vt, NH, Mass, Ct, NJ, Pa.

Cool woods, glades, talus slopes. Soil about neutral to alkaline, pH 7-8(-9).

RHIZOMES creeping, 4-6 mm in diameter, scaly. FRONDS not or slightly dimorphic, fertile pinnae narrower than sterile pinnae, solitary or clustered, 60-110 cm long, not evergreen. STIPE about ½ as long as blade, 15-40 cm long, hairy (at least when young), scaly at bases, with 2 curved bundles at base, often united upward. BLADES lanceolate with long, narrow apex, 25-75 cm long, 10-25 cm wide, pinnate; rachis pale green, with a few brown hairs but no scales. PINNAE 20-30 pairs, mostly alternate, long-acuminate, nearly linear, rounded to semi-hastate at base but not auriculate, sessile or the lowest ones with very short stalks, longest 7-12 cm long, lower pinnae shorter than middle pinnae, glabrous except on veins; margins entire. VEINS free, once or twice forked, reaching the margin. SORI not marginal, linear, straight or slightly curved, silvery green when young, about 20-40 per pinna, separate. INDUSIA laterally attached, conspicuous, glabrous. SPORES bilateral.

Somewhat resembles *Polystichum acrostichoides* but pinnae not auriculate.

Athyrium thelypterioides (Michaux) Desvaux Plate 9

SILVERY SPLEENWORT

Diplazium acrostichoides

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Rich, moist woods, stream banks, marshy ground. Soil acid, pH 5-6(-7).

RHIZOMES creeping, 5-7 mm in diameter, scaly. FRONDS not (or slightly) dimorphic, coming separately (but near together) from the rhizome, (35-)60-110 cm long, not evergreen. STIPE ½-⅘ as long as the blade, (10-)25-40(-75) cm long, with a few hairs, scaly at bases, with 2 curved bundles at base, often united upward. BLADES lanceolate to elliptic, tapering at both ends, 35-80 cm long, (6-)10-20(-30) cm wide, pinnate-pinnatifid to nearly bipinnate; rachis pale green, with hairs and narrow scales (at least when young). PINNAE 15-20 pairs, opposite and alternate, oblong to linear-lanceolate with acuminate apex, sessile, 0.7-2 cm long, about 0.4 cm wide, lowest pinnae shorter than middle pinnae and usually pointing downward; segments oblong, obtuse or acute at apex, with yellowish hairs and a few scales; margins entire or serrulate. VEINS free, rarely forked, reaching the margin. SORI not marginal, linear, straight or slightly curved, 3-7 per segment, separate, but sometimes close together. INDUSIA laterally attached, arching, silvery when young, light brown in age. SPORES bilateral.

Azolla caroliniana Willdenow Plate 10

MOSQUITO FERN

NY, Mass, Ct (?), NJ (?), Pa (?). Occasionally introduced but in many areas it may not long persist.

Floating on quiet water.

Small (5-10 mm wide) mosslike plants. RHIZOMES branched at every third leaf. LEAVES with 2 lobes, upper smaller lobe floating and lower larger lobe submersed, greenish or reddish. SPOROCARPS (sporangia) of 2 kinds, in the leaf axils. The smaller sporocarps contain a single large megaspore. The larger sporocarps contain many tiny microspores. These sporocarps are seldom seen in our area.

A. filiculoides is sometimes reported but probably does not persist. High magnification is needed for separating species of *Azolla*.

Botrychium dissectum Sprengel Plate 11

LACE-LEAF GRAPE FERN

B. obliquum

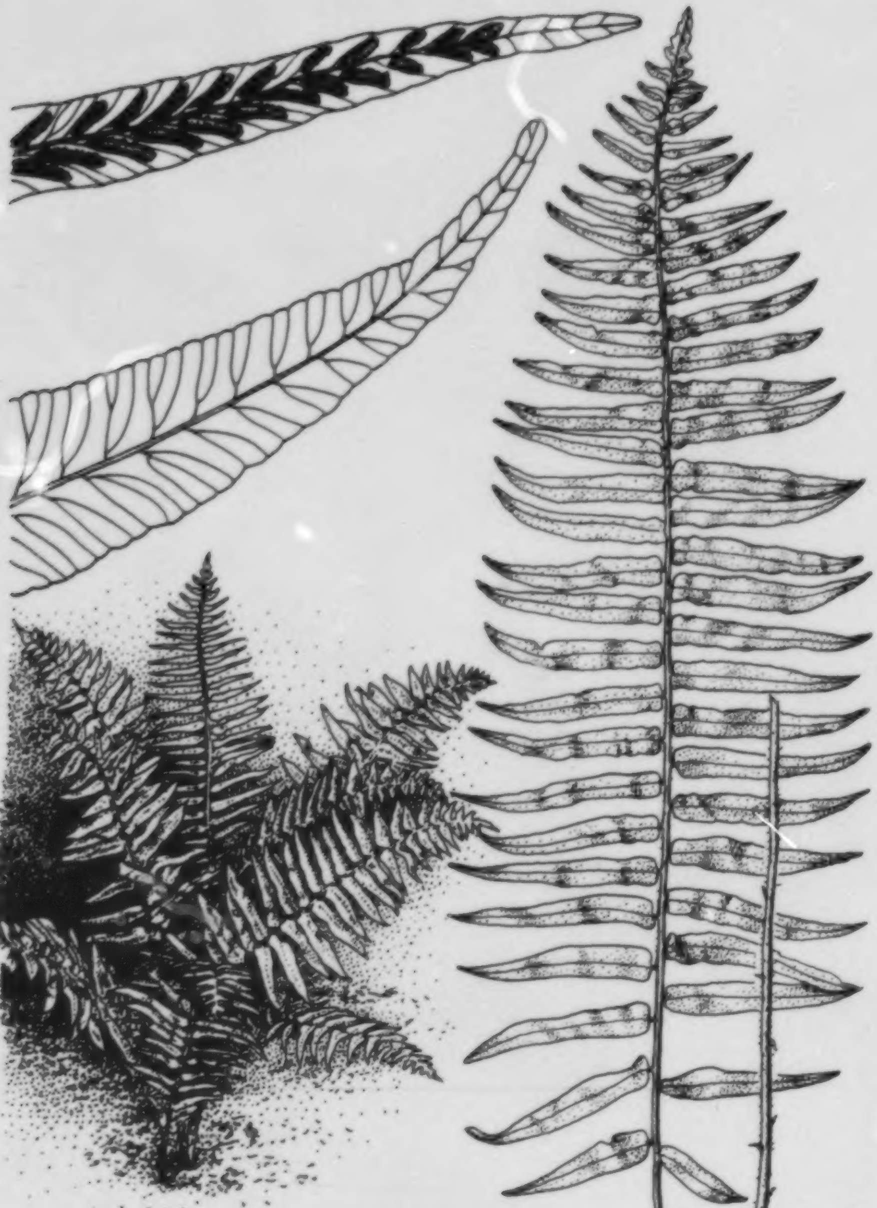
NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Dry or moist woods, fields, pastures, sandy banks. Soil usually acid.

FRONDS dimorphic, solitary, 10-50 cm long, dwarf forms (½ size) occur with normal ones, appearing late summer, evergreen but often becoming bronze after freezing weather. COMMON STIPE 0.5-6 cm long, bearing a sterile and a fertile blade, glabrous or with a few hairs, usually with 1 linear, curved bundle in the shape of a nearly closed ring, sometimes divided into 2-4 upward. STERILE BLADE membranous or slightly leathery, ovate to broad-triangular, 4-8 cm long, 3-12 cm wide, with a stalk 2.5-8 cm long, pinnate-pinnatifid to quadripinnate. STERILE PINNAE opposite, lowest pair longer than middle pairs, glabrous or with a few hairs; margins wavy or with tiny short teeth. VEINS free, forked. FERTILE BLADE 2-14 cm long, on a stalk longer than the common stipe, bipinnate to quadripinnate, mostly tripinnate. SPORANGIA globular, clustered. SPORES tetrahedral.

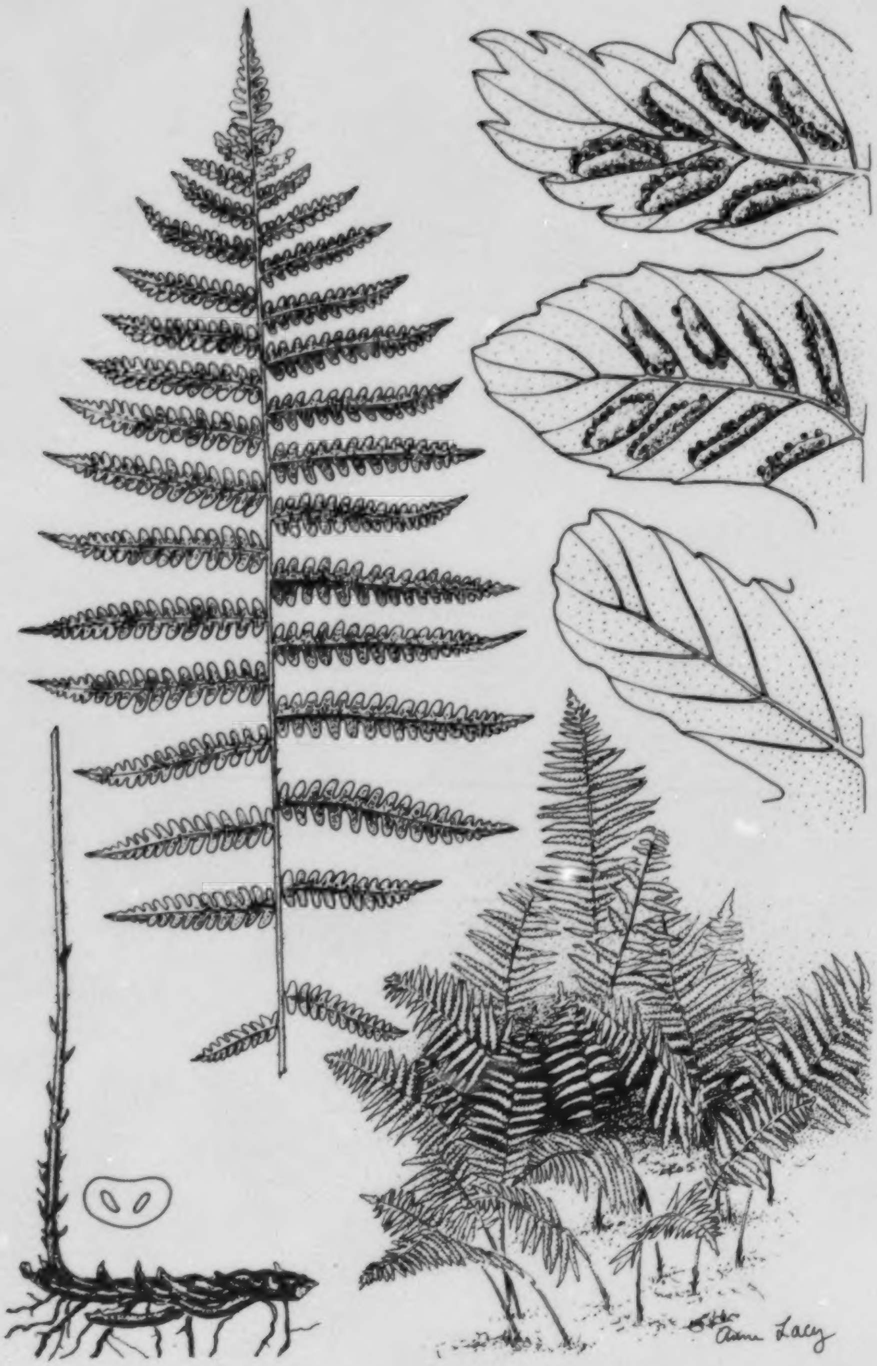
A highly variable species. The variants are recognized as varieties by some and as distinct species by others.

Plate 8



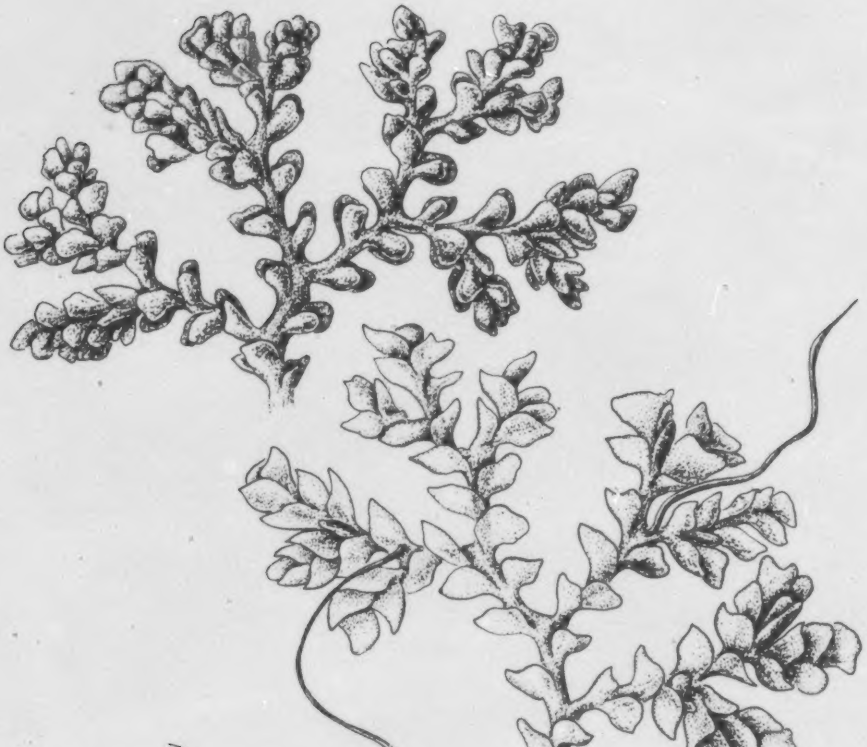
Athyrium pycnocarpon GLADE FERN

Plate 9



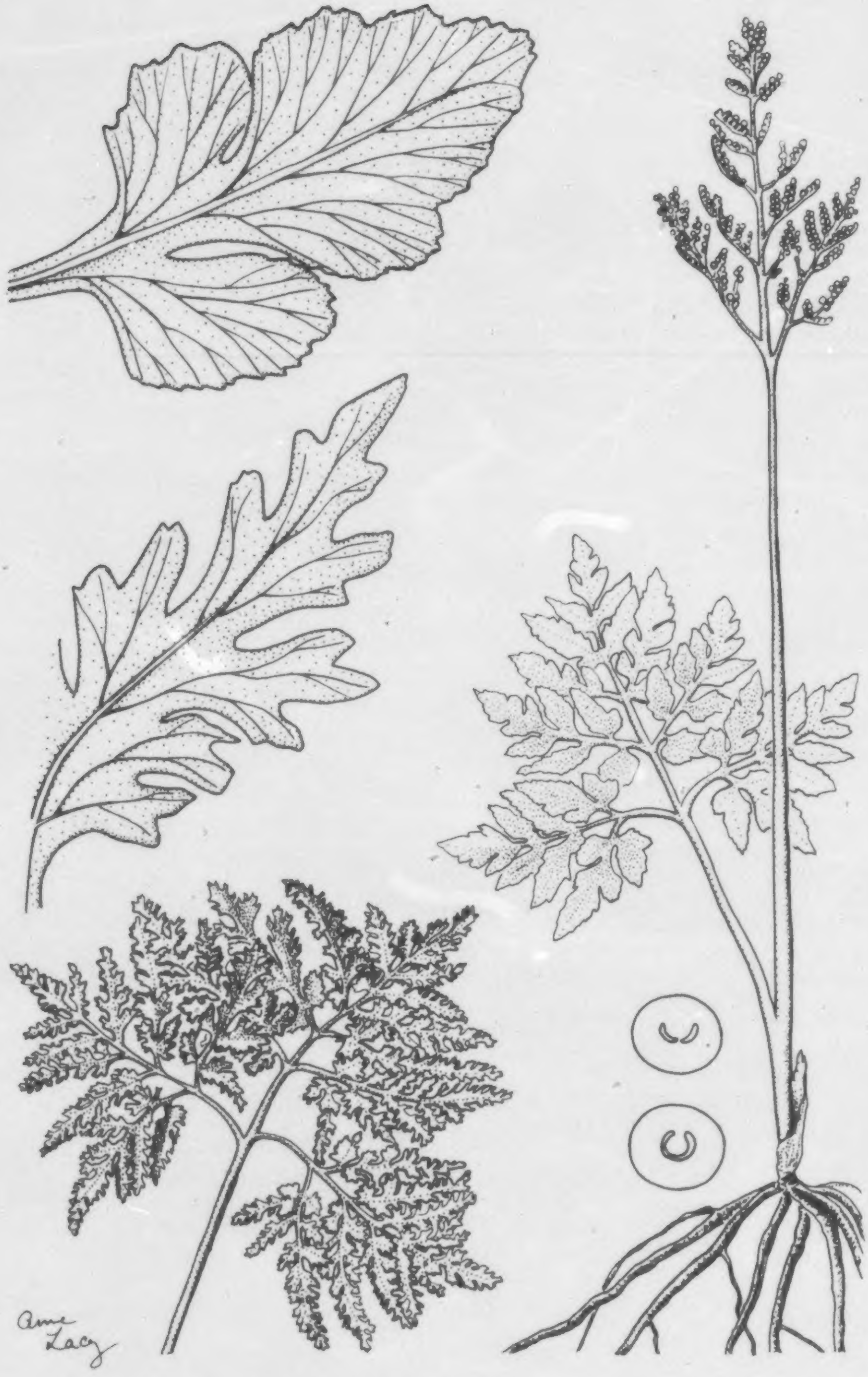
Athyrium thelypterioides SILVERY SPLEENWORT

Plate 10



Azolla caroliniana MOSQUITO FERN

Plate 11



Botrychium dissectum LACE-LEAF GRAPE FERN

Botrychium lanceolatum (Gmelin) Angström Plate 12

LANCE-LEAVED GRAPE FERN

B. angustisegmentum

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Rich soil of moist, cool woods, hummocks, in swamps, meadows, etc. Soil acid, pH usually 4-6.

FRONDS dimorphic, solitary, 5-25(-40) cm long, dwarf forms (½ size) occur with normal ones, found spring through summer, not evergreen. COMMON STIPE 6-20 cm long, often 5 times as long as sterile blade, glabrous, with 2 or more linear, curved bundles arranged in a ring. STERILE BLADE thin or somewhat leathery (sometimes thick and fleshy in the northern parts of our area), triangular, 1-5 cm long, 1.5-4 cm wide, sessile or with a stalk up to 0.6 cm long, pinnate-pinnatifid or bipinnate. STERILE PINNAE opposite, lowest pair longest, glabrous, margins entire. VEINS free, forked. FERTILE BLADES 0.1-1.3 cm long, on a stalk shorter than the common stipe, bipinnate to tripinnate. SPORANGIA globular, clustered, greenish yellow. SPORES tetrahedral, yellowish.

Botrychium lunaria (Linnaeus) Swartz Plate 13

MOONWORT

NY (rare), Vt (rare), NH (rare), Me (rare).

Open fields and slopes, grassy meadows, limestone barrens and woods. Soil neutral or nearly so.

FRONDS dimorphic, solitary, 4-25 cm long, appearing during early spring, withering in summer, not evergreen. COMMON STIPE 1.5-4(-7) cm long, bearing a sterile and a fertile blade, glabrous, with 1 or more bundles arranged in a ring. STERILE BLADE thin or leathery, oblong, 1-6 cm long, 1-3 cm wide, sessile or with a stalk, pinnate. STERILE PINNAE opposite, (2-)3-7(-10) pairs, each pair about equal in size, fanlike or lunate, cuneate at bases, rounded at apex; margins mostly entire, sometimes notched or crenate. VEINS free, forked. FERTILE BLADE on a stalk longer or shorter than the common stipe, pinnate to tripinnate. SPORANGIA globular, clustered. SPORES tetrahedral, yellowish.

Botrychium minganense Victorin, MINGAN MOONWORT, is recognized as a species distinct from *B. lunaria* by some modern authorities on ferns. Both are rare with us and they are not easily distinguished.

Botrychium matricariifolium (Döll) A. Braun Plate 14

DAISY-LEAF GRAPE FERN

B. neglectum

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Rich woods, swamps, moist shaded slopes. Soil acid to neutral, pH 4-7.

FRONDS dimorphic, solitary, 7-30 cm long, found during spring and early summer, not evergreen. COMMON STIPE 6-16 cm long, bearing a sterile and a fertile blade, glabrous, with 2 bundles at base and 2-6 upward. STERILE BLADE thin or slightly leathery, oblong or narrowly triangular, 1.5-6 cm long, 1-4 cm wide, with a stalk 0.2-1.5 cm long, pinnate to pinnate-pinnatifid. STERILE PINNAE opposite or nearly so, lowest pair longer than middle pairs, glabrous; margins entire. VEINS free, forked. FERTILE BLADE 1-7 (-10) cm long, on a stalk shorter than the common stipe, pinnate to tripinnate. SPORANGIA globular, clustered, bright yellow. SPORES tetrahedral, yellowish.

Botrychium multifidum (Gmelin) Ruprecht Plate 15

LEATHERY GRAPE FERN

B. matricariae, *B. silaifolium*

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

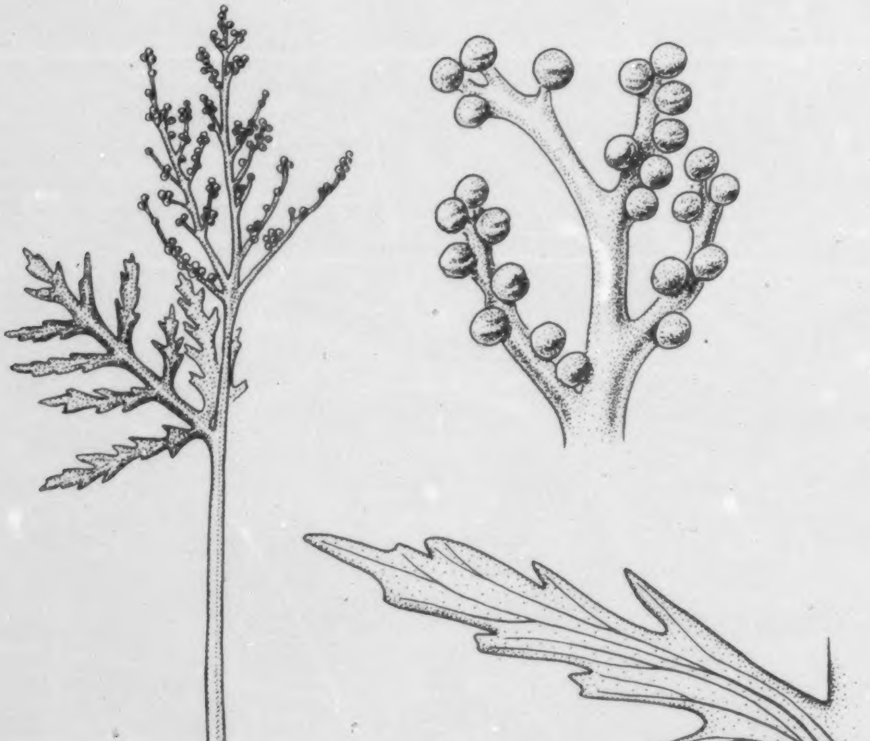
Cool meadows, open fields, moist woods. Soil acid, pH usually 5-6.

FRONDS dimorphic, solitary, 4-25(-50) cm long, dwarf forms occur with normal ones, appearing during spring or early summer, evergreen and usually remaining green after freezing weather. COMMON STIPE 1-5(-8) cm long, bearing a sterile and a fertile blade, glabrous or with a few hairs, usually with 1 linear, curved bundle in the shape of a nearly closed ring, sometimes divided into 2-4 upward. STERILE BLADE leathery and fleshy, triangular, 1-15 cm long, 1-25 cm wide, on a stalk 3-15 cm long, bipinnate to quadripinnate. STERILE PINNAE opposite, lowest pair longer than middle pairs, with a few hairs. STERILE PINNULES usually less than twice as long as wide; margins entire to dentate. VEINS free, forked. FERTILE BLADE 1.2-12(20) cm long, on a stalk longer than the common stipe, bipinnate to tripinnate. SPORANGIA globular, clustered. SPORES tetrahedral, yellowish.

A highly variable species.

Botrychium ternatum (Thunberg) Swartz is recognized as a distinct species by some modern authorities on ferns. It is rare and not easily distinguished from *B. multifidum*.

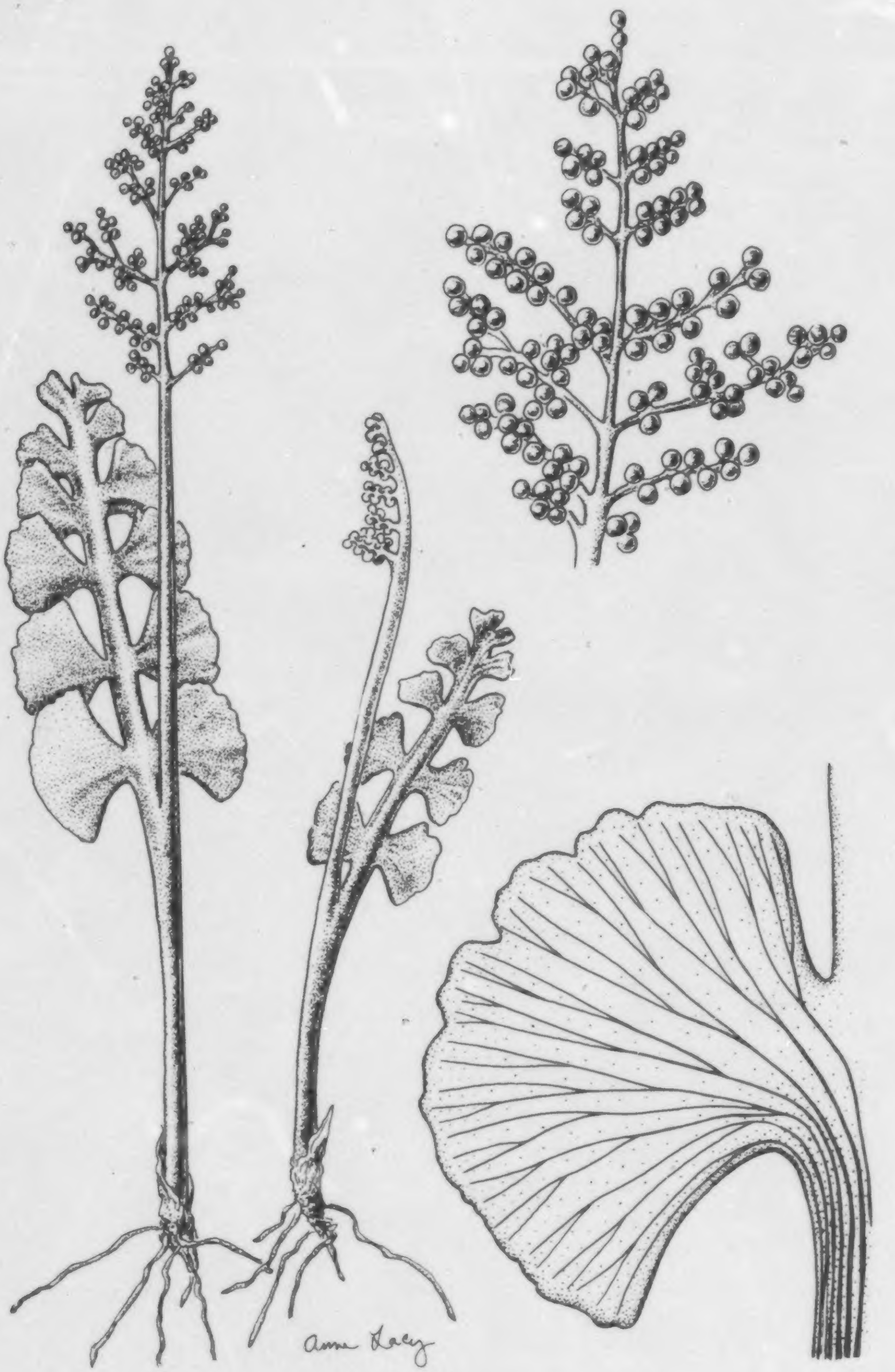
Plate 12



Anne Lacy

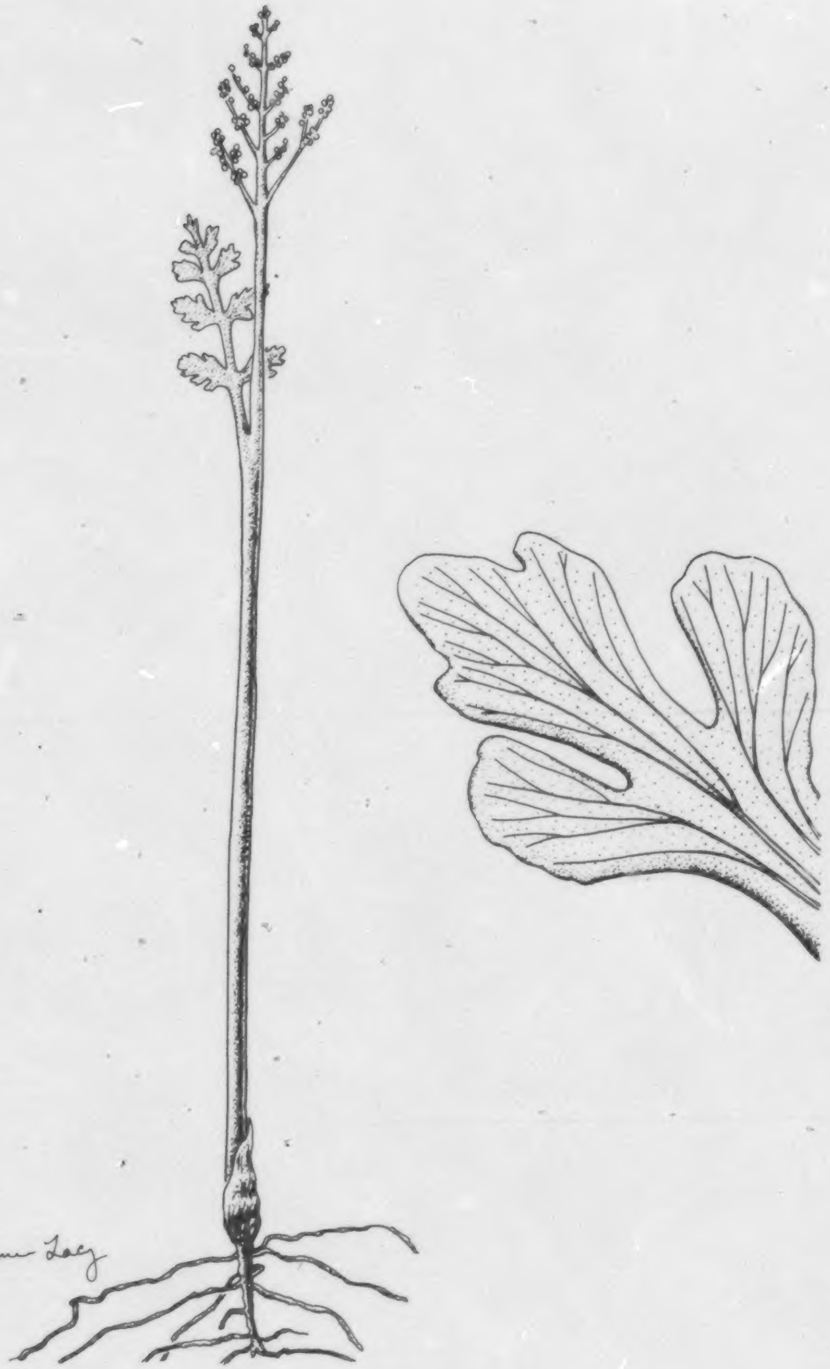
Botrychium lanceolatum LANCE-LEAVED GRAPE FERN

Plate 13



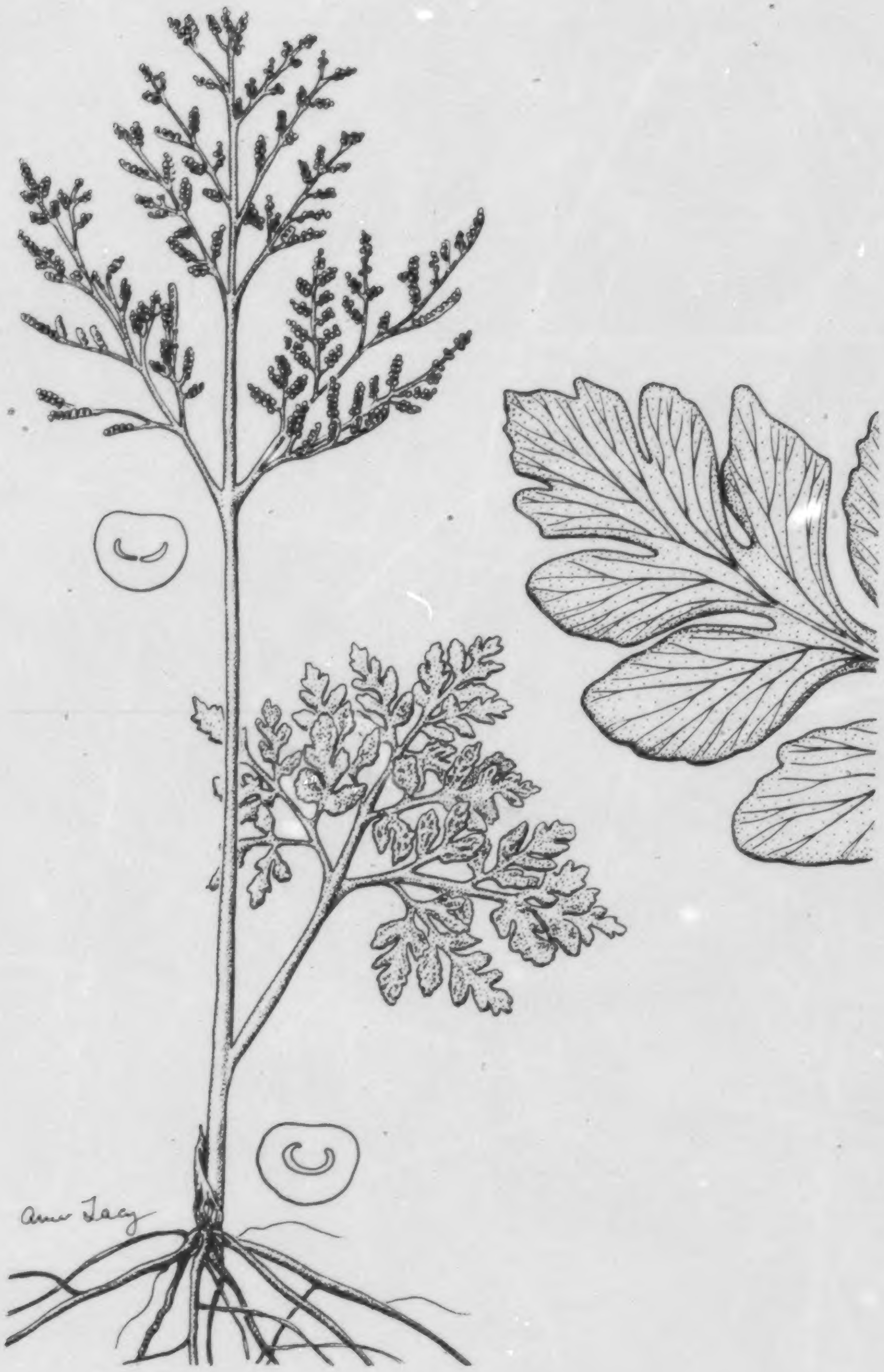
Botrychium lunaria MOONWORT

Plate 14



Botrychium matricariifolium DAISY-LEAF GRAPE FERN

Plate 15



Botrychium multifidum LEATHERY GRAPE FERN

Botrychium oneidense (Gilbert) House Plate 16

ONEIDA GRAPE FERN

B. dissectum forma *oneidense*, *B. multifidum* var. *oneidense*, *B. dissectum* × *multifidum*

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Moist or wet woods. Soil acid.

FRONDS dimorphic, solitary, 10-45 cm long, evergreen and usually remaining bright green after freezing weather. COMMON STIPE 2-4 cm long, bearing a sterile and a fertile blade, glabrous or with a few hairs, usually with 1 linear curved bundle in the shape of a nearly closed ring, sometimes divided, 2-4 upward. STERILE BLADE leathery and fleshy, triangular, mostly 5-10 cm long, 6-12 cm wide, with a stalk 5-10 cm long, ternate, bipinnate to tripinnate. STERILE PINNAE opposite, lowest pair longer than middle pairs, glabrous or with a few hairs. STERILE PINNULES 2-3 times as long as wide, obtuse at apex; margins irregularly toothed. VEINS free, forked. FERTILE BLADE 2-20 cm long, on a stalk longer than the common stipe, mostly tripinnate. SPORANGIA globular, clustered. SPORES tetrahedral.

Easily confused with two highly variable species, *B. multifidum* and *B. dissectum*, often appearing to be a blend between the two. From *B. multifidum* it is distinguished by the pinnule lobes or segments being only about as long as wide and from *B. dissectum* by the pinnules being obtuse at apex.

Botrychium simplex E. Hitchcock Plate 17

DWARF GRAPE FERN

B. tenebrosum

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Cool woods and swamps, meadows, open sterile northfacing slopes. Soil acid, pH usually 5-6.

FRONDS dimorphic, solitary, 2-25 cm long, appearing during early spring, withering by midsummer, not evergreen. COMMON STIPE 1.5-13 cm long, bearing a sterile and a fertile blade, glabrous, with 1 or more bundles. arranged in a ring. STERILE BLADE thin or leathery, ovate or oblong, 0.5-4 cm long, 0.2-3 cm wide, stalk 0.5-2 cm long, mostly pinnate, sometimes only pinnatifid, rarely ternate or bipinnate. STERILE PINNAE opposite or nearly so, 1-4(-5) pairs, each pair about equal in size, fanlike, cuneate at base, rounded at apex; margins entire, sometimes lobed. VEINS free, forked. FERTILE BLADE on a stalk longer or shorter than the common stipe, simple or pinnate or bipinnate. SPORANGIA globular, clustered. SPORES tetrahedral, yellowish.

Botrychium virginianum (Linnaeus) Swartz Plate 18

RATTLESNAKE FERN, VIRGINIA GRAPE FERN

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Moist or dry woods, swamps, meadows. Soil acid to neutral, pH usually 5-7.

FRONDS dimorphic, solitary, 25-75 cm long, dwarf forms (½ size) are frequent, appearing spring to fall, not evergreen. COMMON STIPE 7-35 cm long, each bearing a sterile and usually a fertile blade, with a few hairs, with 2 or more bundles, often with 2 linear, curved bundles and 2 circular bundles. STERILE BLADE thin, not leathery, triangular, 4-30 cm long, 4-40 cm wide, sessile or nearly so, bipinnate-pinnatifid to nearly tripinnate. STERILE PINNAE opposite, lowest pair longer than middle pairs, usually with a few hairs; margins with teeth. VEINS free, mostly once-forked. FERTILE BLADE 2-18 cm long, on a stalk about same length as the common stipe, bipinnate to tripinnate. SPORANGIA globular, clustered. SPORES tetrahedral, yellowish or cream-colored.

The largest and commonest of our species of *Botrychium*. The fertile blade is often absent, but evidence of it usually appears as a short stub.

Camptosorus rhizophyllus (Linnaeus) Link Plate 19

WALKING FERN

Asplenium rhizophyllus

NY, Vt, NH, Me (rare or extinct), Mass, Ct, RI (rare), NJ, Pa.

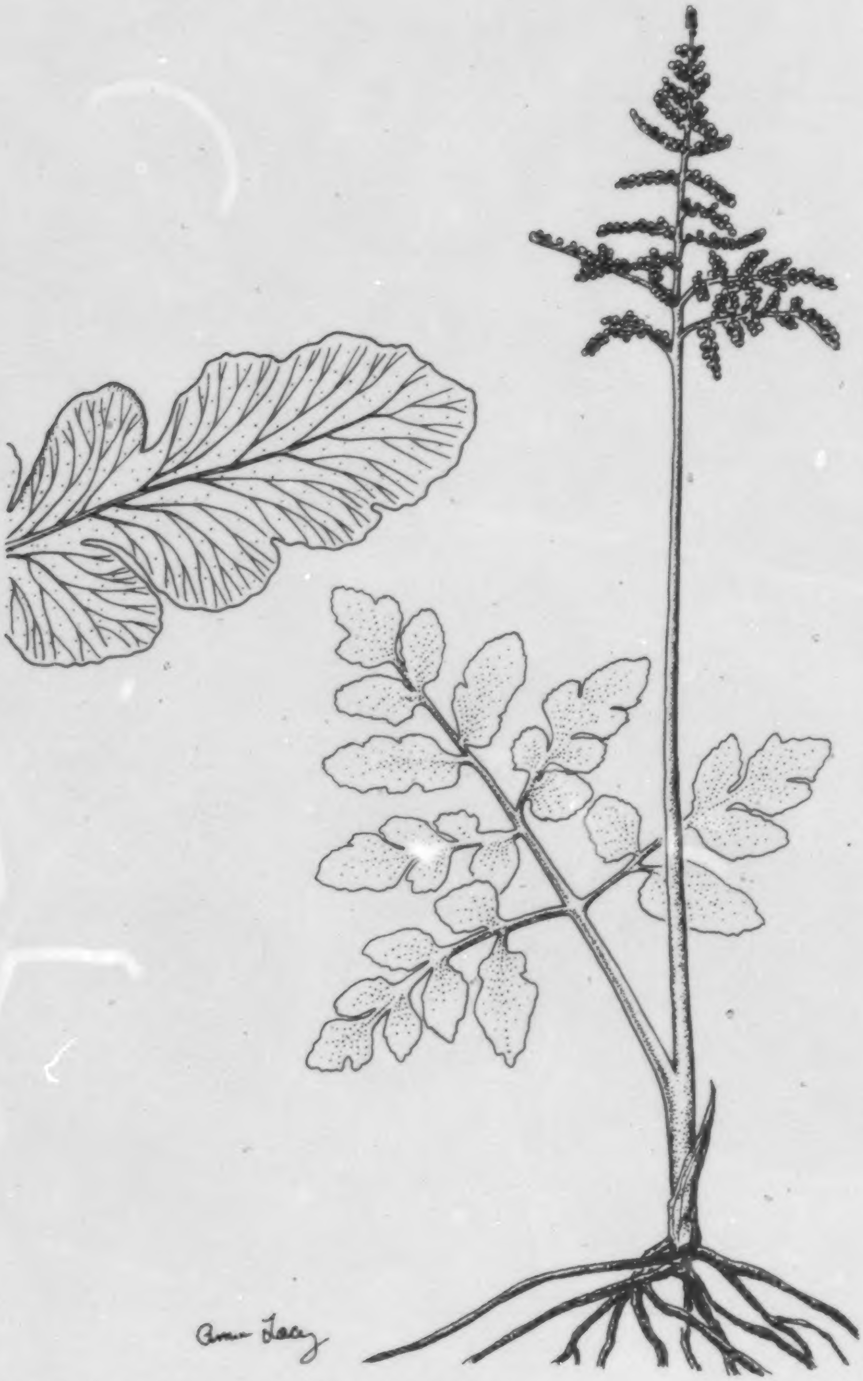
On thin soil on rocks, crevices in cliffs, on talus slopes, etc. Does best on limy rock but found also on other rocks. Soil usually about neutral.

RHIZOMES short, erect, about 2 mm in diameter, scaly. FRONDS not dimorphic, clustered, 5-20 cm long, evergreen. STIPES variable in length, dark brown and scaly at base, green and without scales above, with 2 bundles at base, united upward. BLADES lance-linear, cordate at base, with a long tapering apex, (5-)10-30 cm long, (1-)1.5-3 cm wide at base, not dissected, lobed at base, without hairs or scales; margins entire. VEINS reticulate, the outer ones free, not reaching the margin. SORI linear, not marginal, borne along the veins. INDUSIA large, laterally attached. SPORES bilateral.

Often rooting at the apex of the blade, which is sometimes forked.

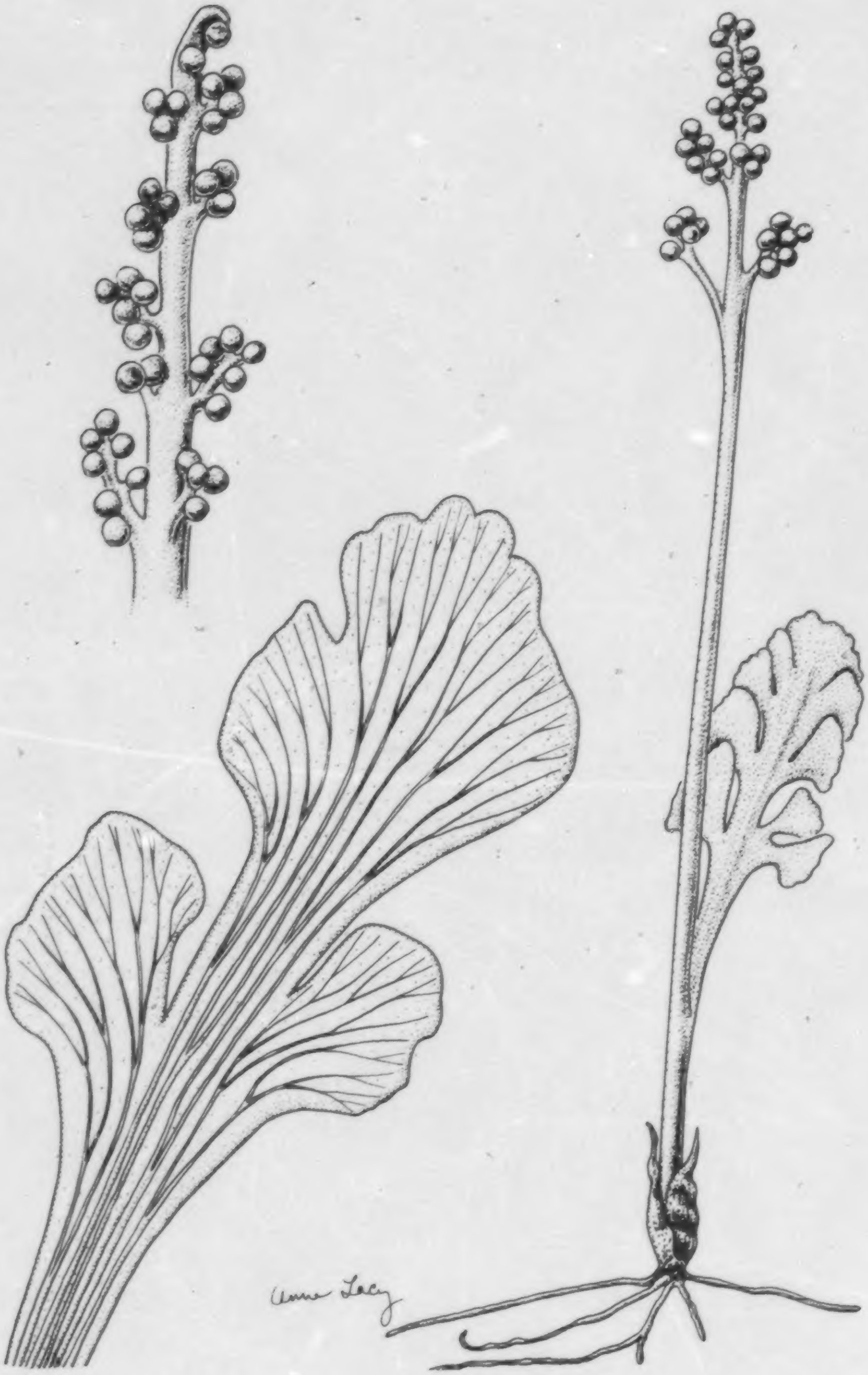
Closely related to *Asplenium* species, with several of which it may form hybrids. These hybrids are by some placed in the genus *Asplenosorus*.

Plate 16



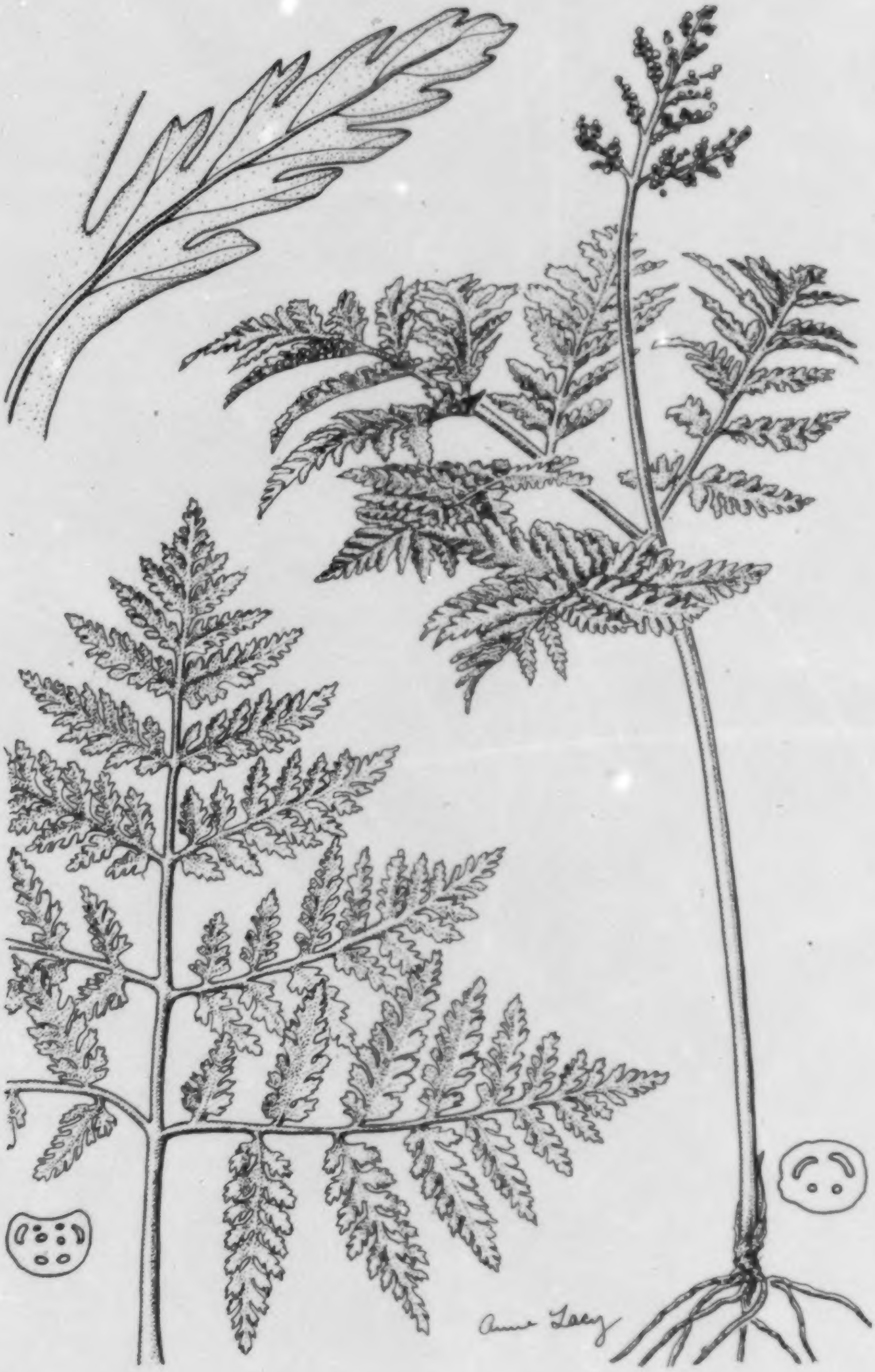
Botrychium oneidense ONEIDA GRAPE FERN

Plate 17



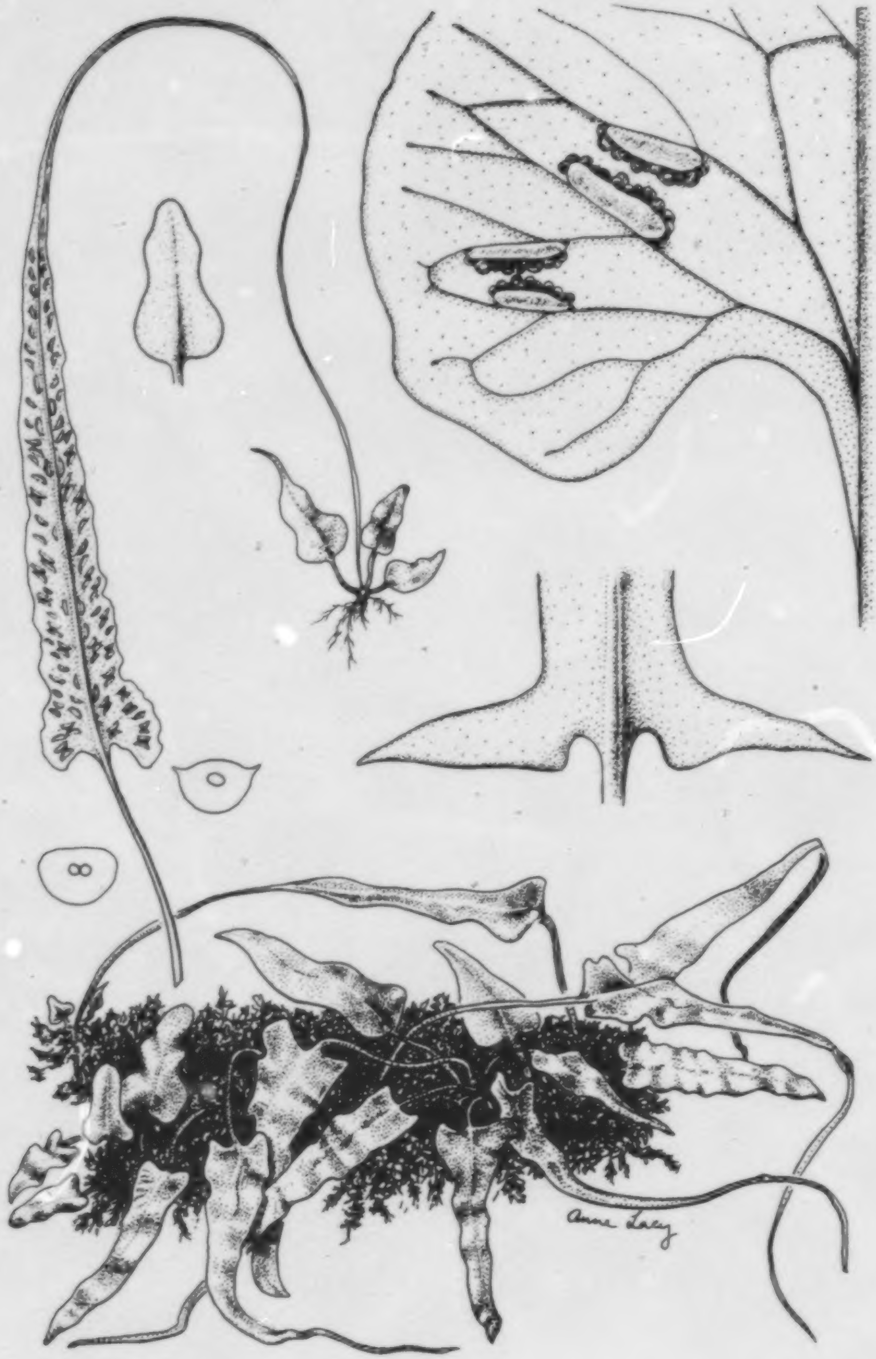
Botrychium simplex DWARF GRAPE FERN

Plate 18



Botrychium virginianum RATTLESNAKE FERN

Plate 19



Camptosorus rhizophyllus WALKING FERN

Cheilanthes lanosa (Michaux) D. C. Eaton Plate 20

HAIRY LIP FERN

C. vestita

NY (rare), Ct (rare), NJ, Pa.

Dry rocky slopes and cliffs. Soil mostly acid, sometimes neutral, or even slightly alkaline.

RHIZOMES branched, scaly, without hairs. FRONDS not dimorphic, with several clusters from points on the rhizome, 10-30 cm long, evergreen. STIPE shorter than the blade, 2-8 cm long, slender, wiry, dark brown, with dense, septate, brownish hairs but no scales, with 1 curved bundle (rarely 2). BLADES oblong-lanceolate, 8-30 cm long, 2-7 cm wide, bipinnate to tripinnate, mostly bipinnate-pinnatifid; rachis with hairs like those on the stipe, without scales. PINNAE opposite or subopposite below, mostly alternate above, 12-20 pairs, deltoid-lanceolate to ovate-oblong, widely spaced below, crowded upward. PINNULES 7-10 pairs on a pinna, hairy on both sides; margins lobed but entire. VEINS free, mostly forked at the ends, not reaching the margin. SORI marginal or nearly so, at the ends of the veins, circular to oblong. INDUSIA only the reflexed, unmodified, green margin of the pinnule. SPORES tetrahedral.

The blades may shrivel during dry weather but revive after rain.

Cryptogramma stelleri (Gmelin) Prantl Plate 21

SLENDER CLIFF BRAKE

NY, Vt, NH (rare), Me (rare), Mass (rare), Ct (rare), NJ, Pa. Often rare or overlooked.

Cool, moist, shady ledges of limestone or other calcareous rock. Soil neutral to alkaline.

RHIZOMES slender, 0.5-1 mm in diameter, hairy, scaly. FRONDS dimorphic, rising from separate points on the rhizome, not evergreen; sterile fronds 7-15 cm long, fertile fronds longer. STIPES of both usually longer than their blades, hairy at base, glabrous above, with 1 tiny circular or slightly curved bundle. STERILE BLADES ovate, 3-6(-8) cm long, 2-5(-6) cm wide, pinnate-pinnatifid to bipinnate (sometimes bipinnate-pinnatifid); rachis greenish, without hairs or scales. STERILE PINNAE 5-6 pairs, alternate or opposite, lowest longest. STERILE PINNULES 1-3 pairs per pinna; margins entire or toothed. VEINS free, forked, not reaching the margin. FERTILE BLADES ovate, bipinnate to tripinnate or quadripinnate. FERTILE PINNULES linear-lanceolate. SORI marginal, circular to linear. True INDUSIA absent; leaf margin forms a false indusium when young—opens flat in age. SPORES tetrahedral.

Cystopteris bulbifera (Linnaeus) Bernhardi Plate 22

BULBLET BLADDER FERN

Filix bulbifera

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Wet, shaded rocks, ledges, ravines, talus slopes, limestone and calcareous shales, sometimes hummocks in limy swamps. Soil neutral to alkaline, pH usually 7-9.

RHIZOMES with a few brown scales. FRONDS not dimorphic, usually clustered, 30-80(-150) cm long, not evergreen. STIPE shorter than the blade, slender, mostly glabrous, pinkish, with a few scales at base, with 2 oval or oblong bundles at base, these united near the blade or in the rachis. BLADES narrowly triangular to linear-lanceolate, long-tapering, 25-45 cm long, 6-15 cm wide, pinnate-pinnatifid to bipinnate-pinnatifid; rachis glabrous or with a few hairs, with bulblets usually present on the under side. PINNAE 20-40 pairs, nearly opposite at base, becoming alternate upward, basal pinnae slightly longer than next pair above. PINNULES or segments glabrous or with a few hairs; margins denticulate. VEINS free, forked or not, mostly running to the sinuses between the teeth. SORI few, not marginal, circular, separate. INDUSIA laterally attached, hoodlike. SPORES bilateral, spiny.

Cystopteris fragilis (Linnaeus) Bernhardi Plate 23

FRAGILE FERN, BRITTLE FERN

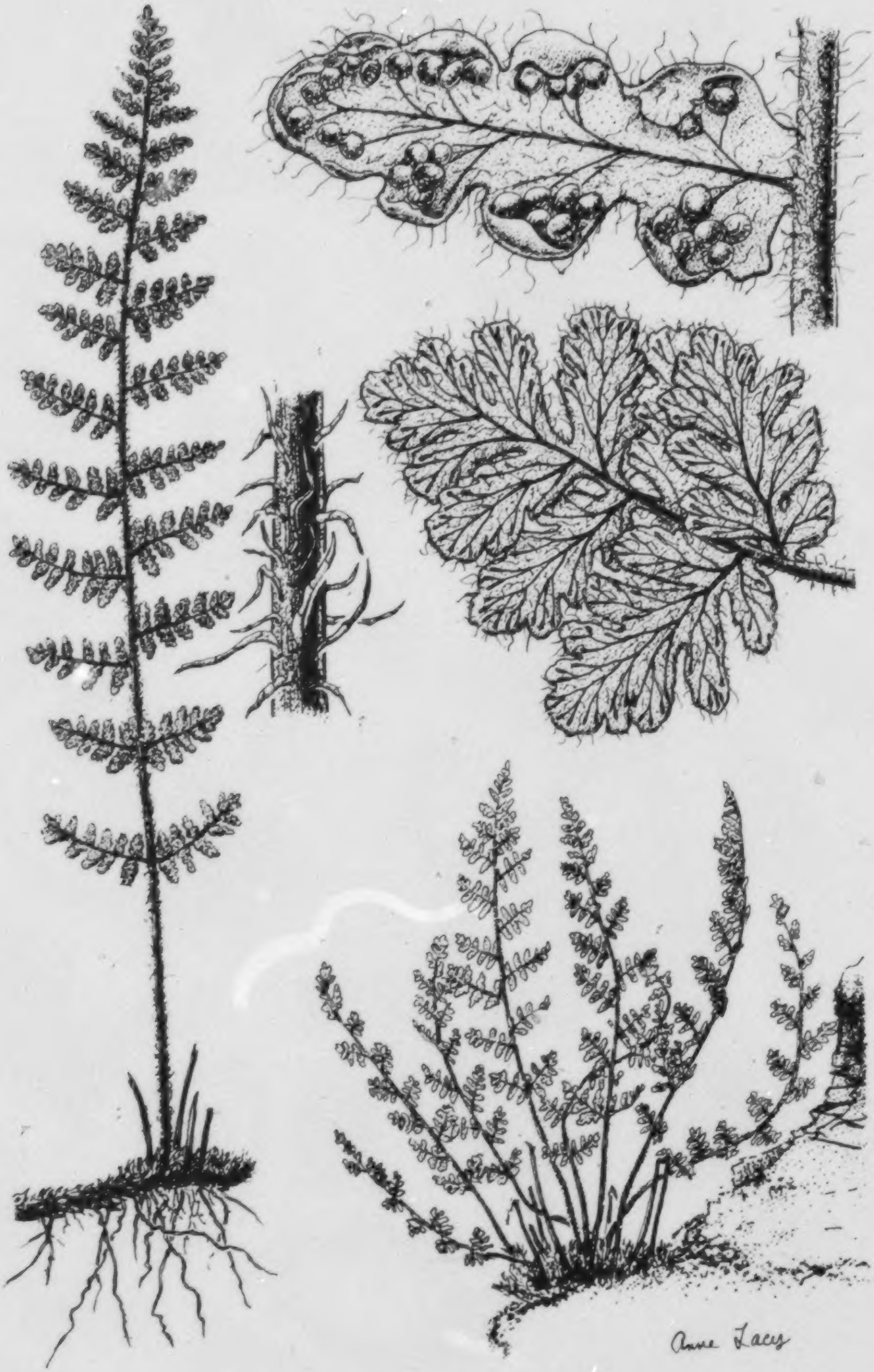
Filix fragilis, C. mackayi, C. protrusa.

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

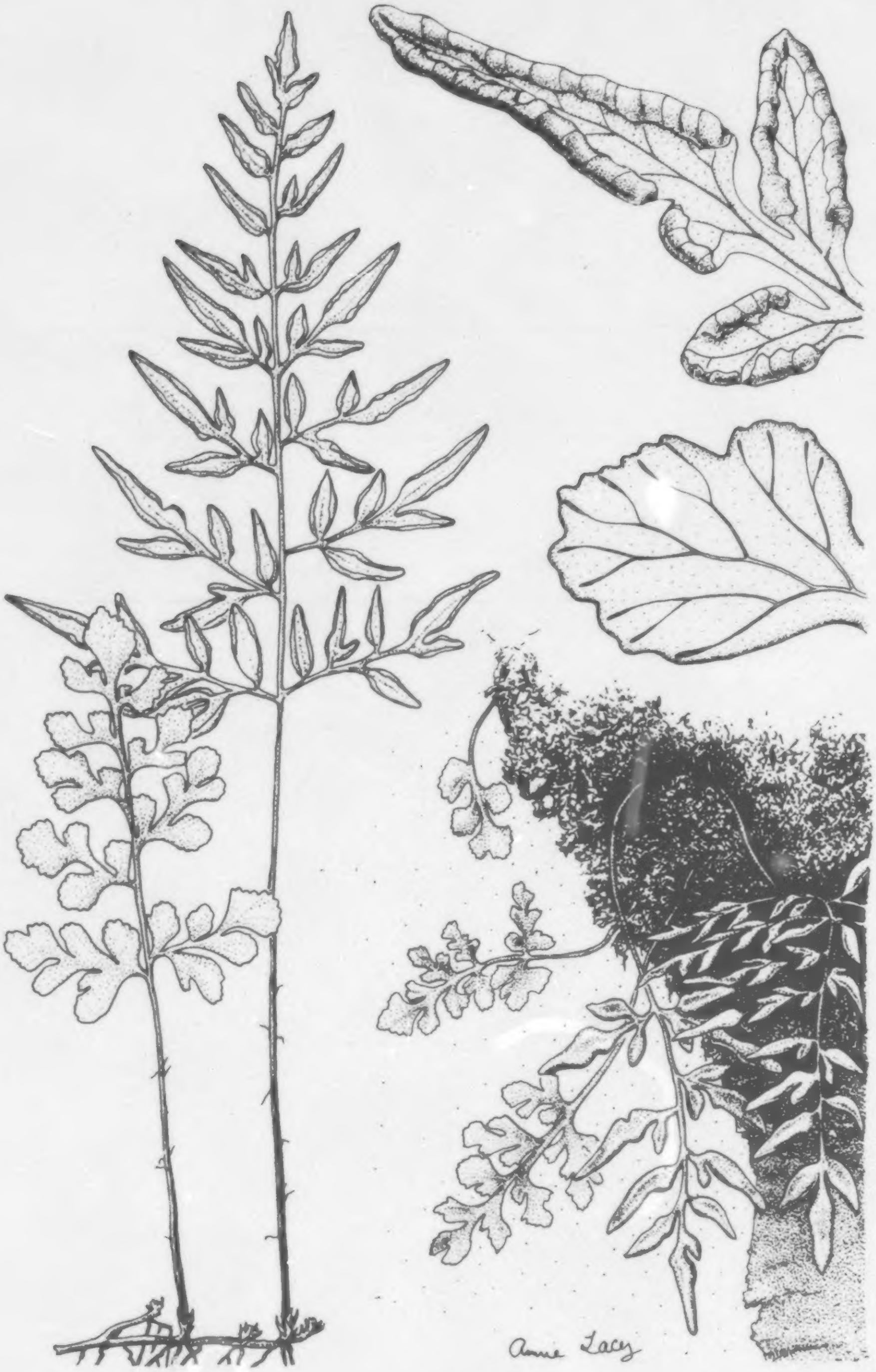
Moist, humus-rich crevices in cliffs, among rocks, mossy slopes, shady alluvial soil, sometimes grassy woods. Soil usually neutral to acid, pH usually 5-7.

RHIZOMES with pale-brown scales. FRONDS not dimorphic, usually clustered, 10-25(-45) cm long, not evergreen. STIPE usually shorter than the blade, mostly glabrous, with a few scales at base, with 2 circular or oval bundles at base, these united near the blade or in the rachis. BLADES variable, usually ovate-lanceolate, (5-)10-20(-30) cm long, (3-)4-8(-12) cm wide, pinnate-pinnatifid to bipinnate or bipinnate-pinnatifid, rarely tripinnate; rachis glabrous, except for a few hairs at the base of the pinnae. PINNAE 9-15 pairs, opposite or nearly so, basal pinnae slightly shorter than the pair next above. PINNULES glabrous; margins denticulate. VEINS free, forked or not, mostly running to the teeth. SORI few, submarginal, circular, separate. INDUSIA laterally attached, hoodlike, often disappearing with age. SPORES bilateral, spiny.

Plate 20

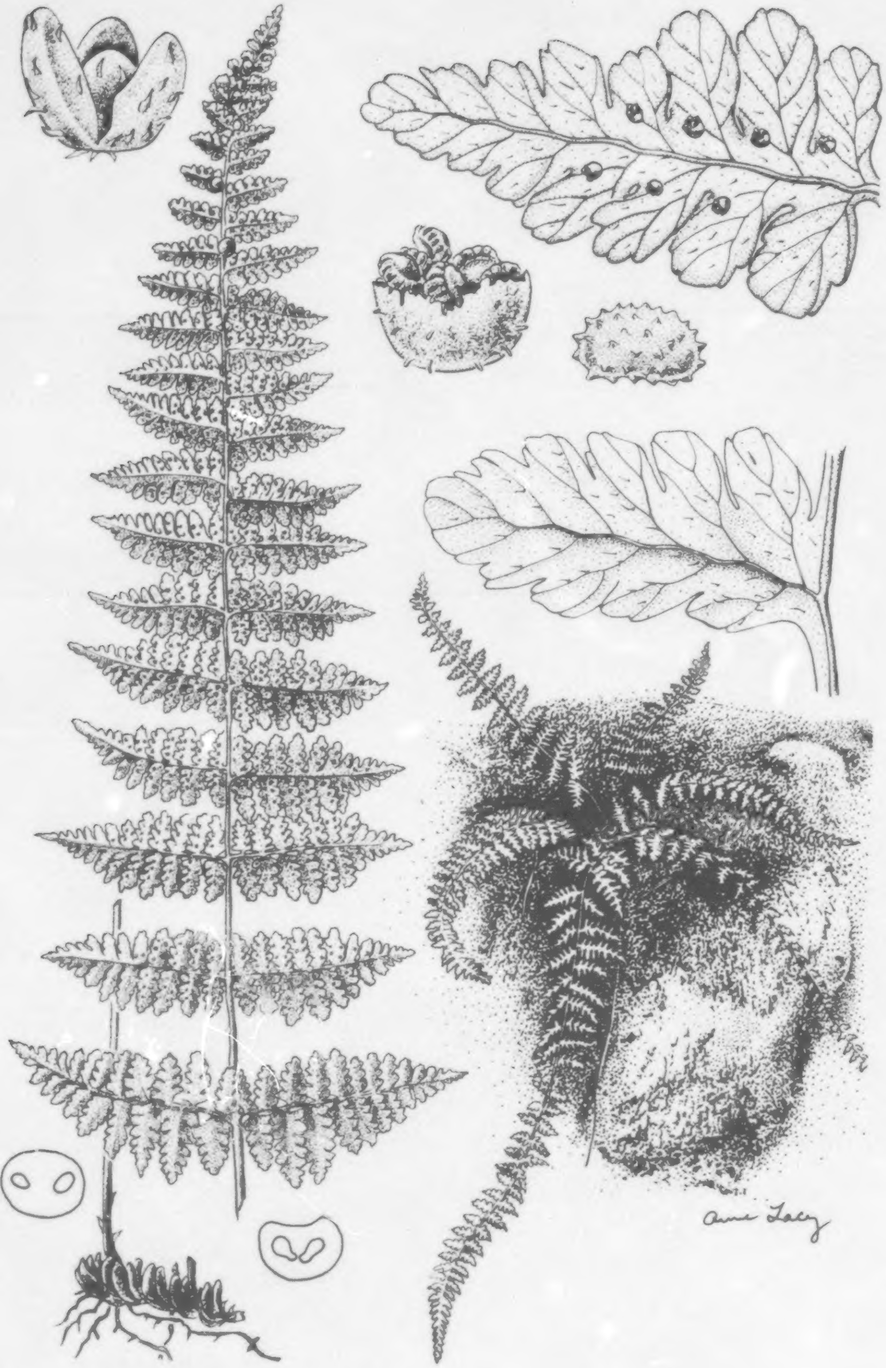


Cheilanthes lanosa HAIRY LIP FERN



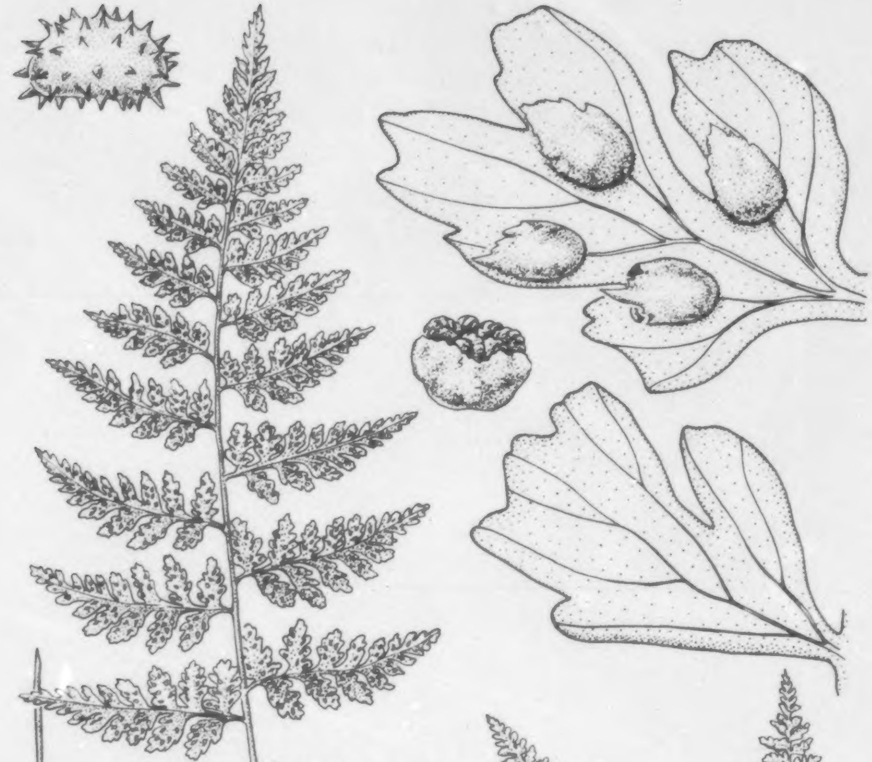
Cryptogramma stelleri SLENDER CLIFF BRAKE

Plate 22



Cystopteris bulbifera BULBLET BLADDER FERN

Plate 23



Cystopteris fragilis FRAGILE FERN

Resembles *Woodsia obtusa* which has a few scales on the rachis; *Cystopteris* does not. A highly variable species. *Cystopteris mackayi* and *C. protrusa* may be distinct species, and are so treated by some authors.

Dennstaedtia punctilobula (Michaux) Moore Plate 24

HAY-SCENTED FERN, BOULDER FERN

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Open woods, rocky places, cleared land, sometimes in wet places, thrives in open sun. Soil acid.

RHIZOMES slender, creeping, branching, 1-3 mm in diameter, hairy, scales absent or few. CROZIERS covered with silvery-white glandular hairs. FRONDS not dimorphic, coming separately from points on the rhizome, (25-)40-80(-120) cm long, not evergreen. STIPE shorter than the blade, 10-22 cm long, mostly 1.5-2.5 mm wide, chestnut-brown or nearly black below, greenish or yellowish above, glabrous or slightly hairy, with 1 horseshoe-shaped bundle that is not (or slightly) curved at the free ends (may be V-shaped in young fronds). BLADES lanceolate to ovate-lanceolate, (15-)20-40(-90) cm long, 10-25 cm wide, bipinnate to bipinnate-pinnatifid; rachis slender, hairy. PINNAE 17-30(40) pairs, opposite or alternate, lanceolate, largest 8-12 cm long, 2-3 cm wide, lower ones slightly shorter than middle ones. PINNULES 14-25 pairs per pinna, opposite or alternate, oblong to oblong-lanceolate, 1-2 cm long, with many small, whitish gland-tipped, hay-scented (especially when drying) hairs on upper and lower side; margins serrate. VEINS free, forked or not, not reaching the margin. SORI marginal, small, circular, at ends of the veins. INDUSIA cuplike, whitish. SPORES tetrahedral.

Dryopteris campyloptera (Kunze) Clarkson Plate 25

MOUNTAIN WOOD FERN, SPREADING SHIELD FERN

D. assimilis, D. austriaca var. *austriaca, D. dilatata, D. spinulosa* var. *americana, D. spinulosa* var. *dilatata, Thelypteris dilatata.*

NY, Vt, NH, Me, Mass, Pa.

Rocky, humus-rich woods, swamp margins, especially at higher elevations. Soil acid, pH mostly 5-6.

RHIZOMES stout, creeping to nearly erect, scaly, with old stipe bases. FRONDS not dimorphic, clustered, 45-100 cm long, not evergreen. STIPE shorter than blade, straw-colored, densely scaly, with 3-7(-9) circular bundles near base and upward. BLADES ovate-lanceolate, 30-60 cm long, 20-40 cm wide, bipinnate or bipinnate-pinnatifid to nearly tripinnate; rachis scaly. PINNAE opposite or alternate, lowest pair obliquely triangular, about as long as middle pinnae. PINNULES narrowly triangular or ovate-lanceolate, the lowest basal pinnule on the lower side of the lowest pinna longer than the other pinnules and three to five times as long and twice as wide as the opposing pinnule; margins with bristle-tipped teeth. VEINS free, forked, mostly not reaching the margin. SORI not marginal, circular, separate. INDUSIA reniform, often circular but with a sinus, glabrous or rarely glandular. SPORES bilateral.

Dryopteris clintoniana (D.C. Eaton) Dowell Plate 26

CLINTON'S SHIELD FERN, BROAD SWAMP FERN

D. cristata var. *clintoniana, Thelypteris c.*

NY, Vt, NH, Me, Mass, Ct, RI, NJ (?), Pa.

Swamps and wet woods. Soil acid, pH mostly 5-6.

RHIZOMES stout, short-creeping, scaly, with old stipe bases. FRONDS not dimorphic, borne in 1 or 2 rows along the rhizome, (15-)35-80(-120) cm long, usually evergreen. STIPE shorter than blade, straw-colored, scaly (at least at base), with 3-7(-9) circular bundles at base and upward. BLADES lanceolate or lanceolate-oblong, 30-60 cm long, 10-30 cm wide, pinnate-pinnatifid to bipinnate-pinnatifid; rachis with a few scales. PINNAE opposite or alternate, 10-15 pairs, oblong-lanceolate, short-stalked, lowest pair triangular and slightly shorter than middle pinnae; margins serrate or crenate, the teeth somewhat bristle-tipped. VEINS free, forked, mostly not reaching the margin. SORI not marginal, circular, separate. INDUSIA reniform, often circular but with a sinus, glabrous. SPORES bilateral.

Similar to *D. cristata* and sometimes treated as a variety of that species.

Hybrids between this species and other species of *Dryopteris* are known, notably with *D. cristata* and *D. goldiana*.

Dryopteris cristata (Linnaeus) A. Gray Plate 27

CRESTED SHIELD FERN, NARROW SWAMP FERN

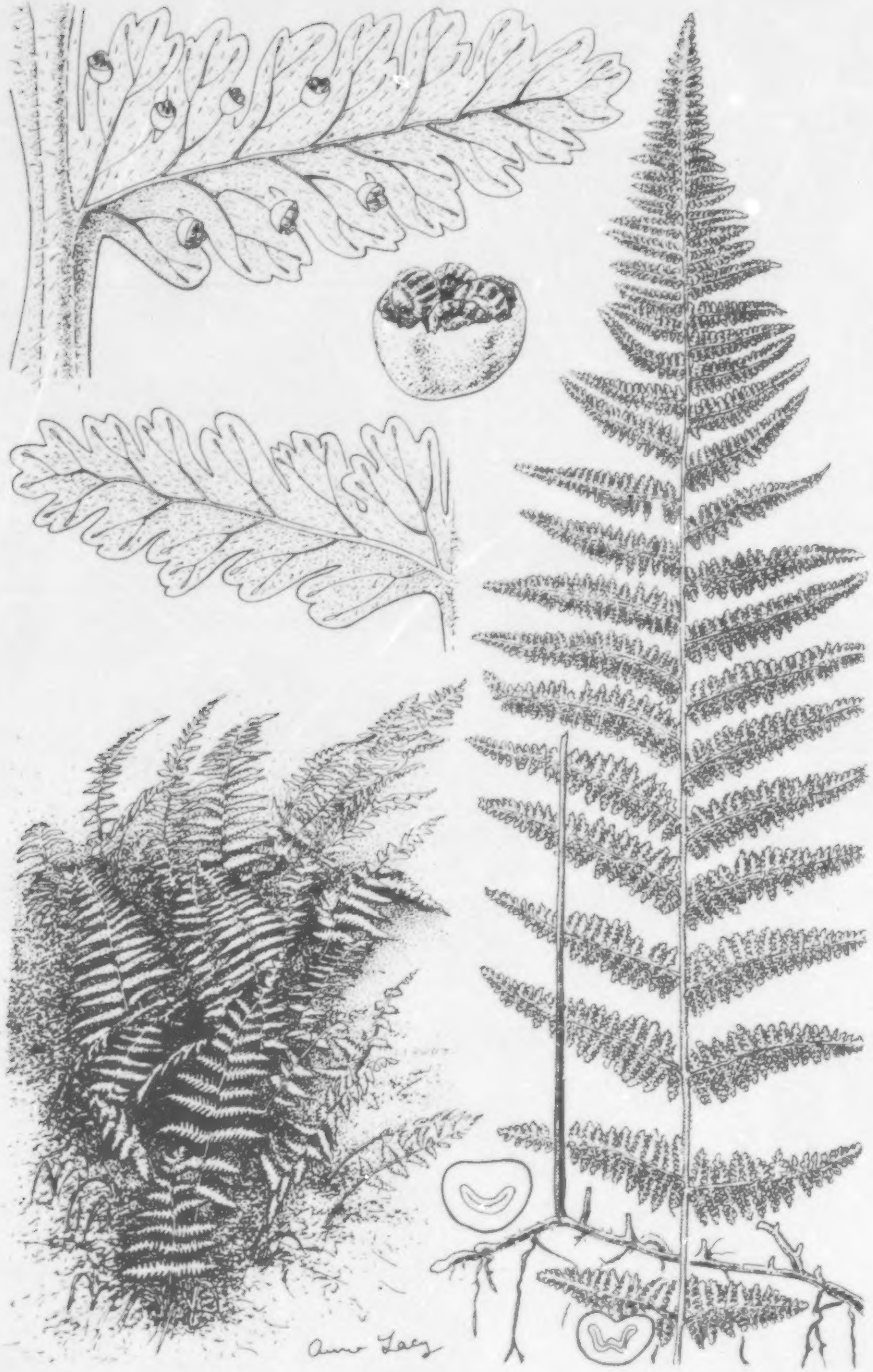
Thelypteris cristata

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Wet woods, marshes, swamps, bogs, meadows. Soil acid, pH mostly 5-6.

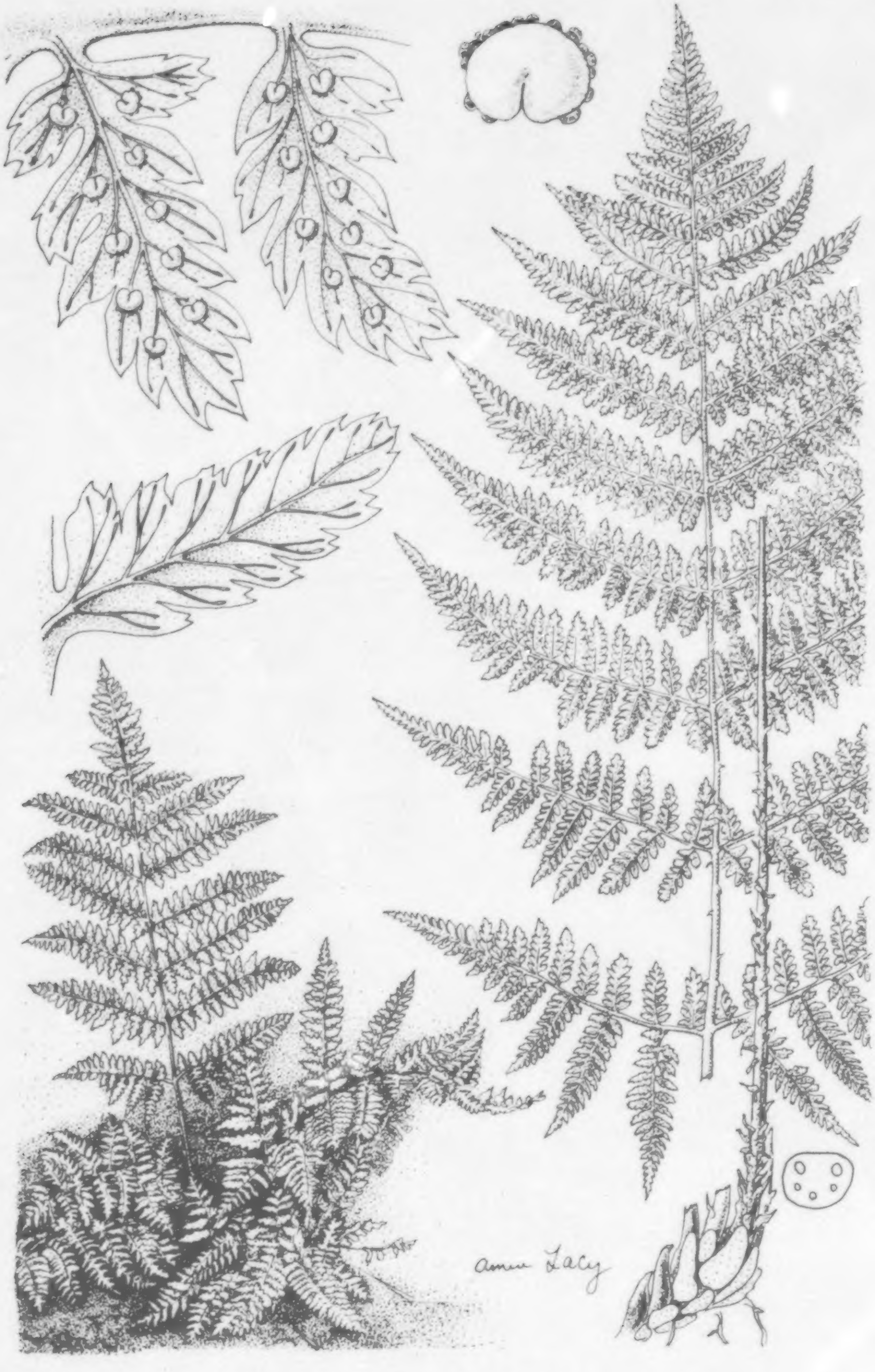
RHIZOMES stout, short-creeping, scaly, with old stipe bases. FRONDS not dimorphic, except that fertile fronds are usually taller than the sterile fronds and less evergreen, borne in 1 or 2 rows along the rhizome, (15-)35-80(-120) cm long, sterile fronds usually evergreen. STIPE usually shorter than blade, straw-

Plate 24



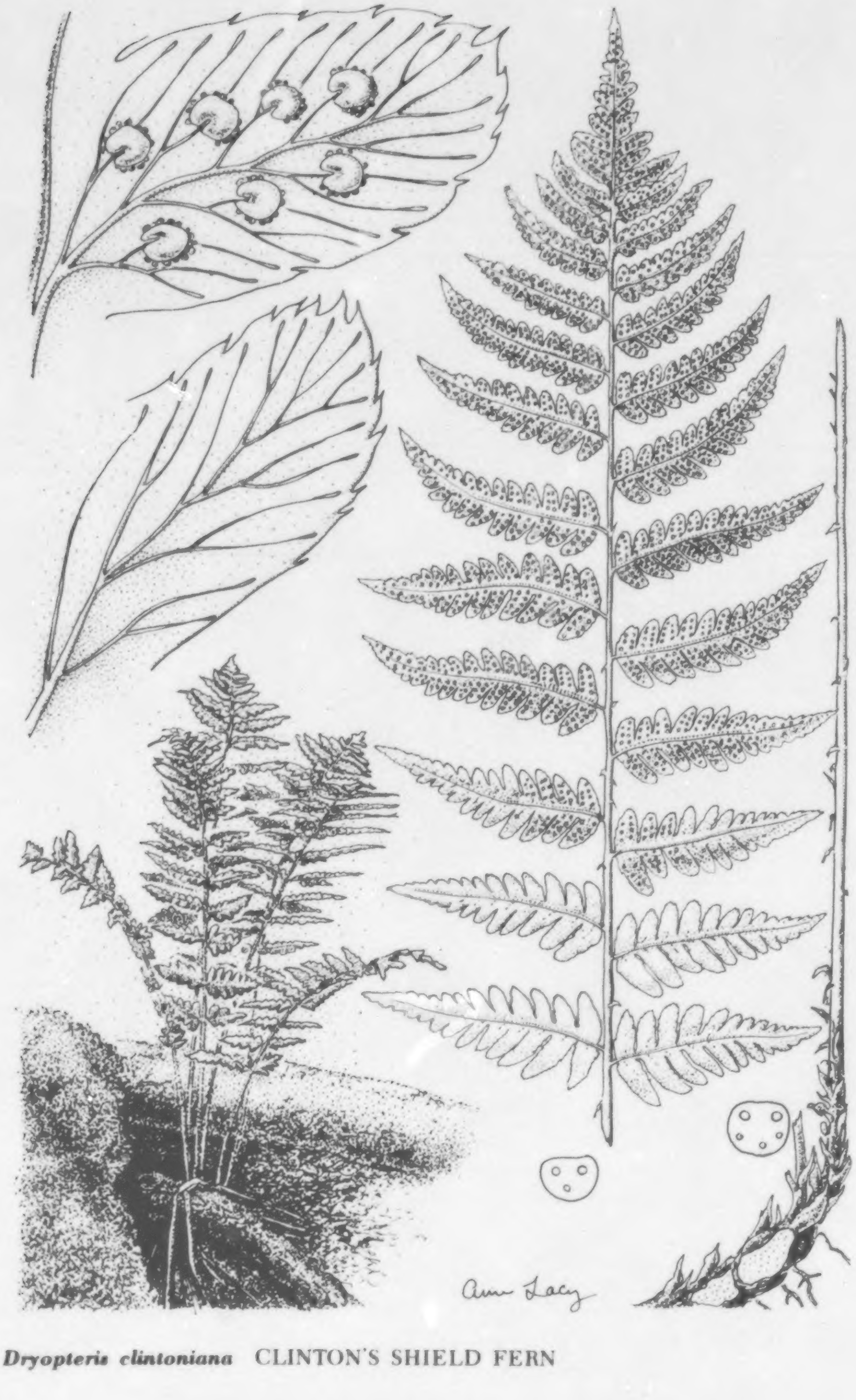
Dennstaedtia punctilobula HAY-SCENTED FERN

Plate 25



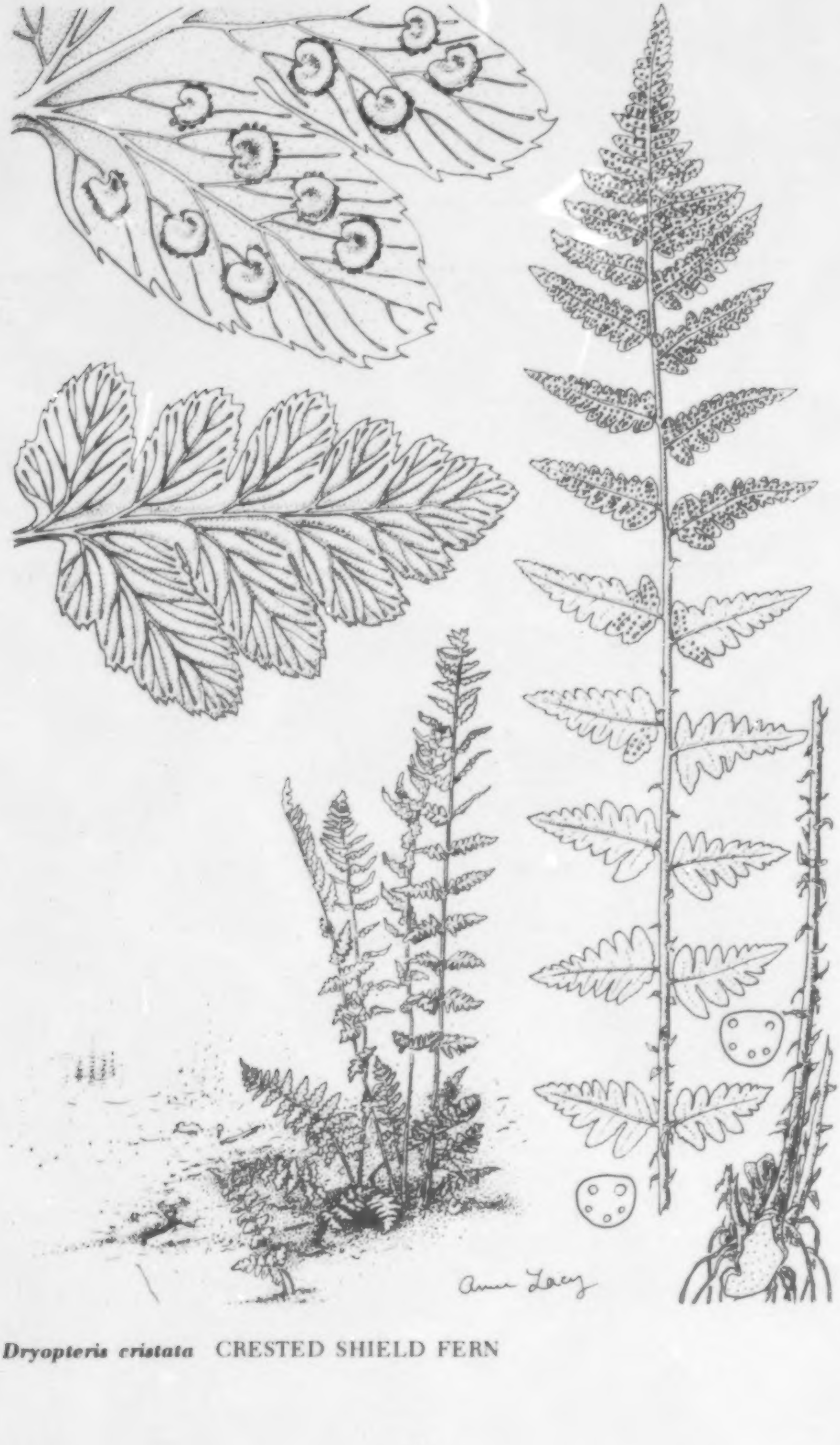
Dryopteris campyloptera: MOUNTAIN WOOD FERN

Plate 26



Dryopteris clintoniana CLINTON'S SHIELD FERN

Plate 27



Dryopteris cristata CRESTED SHIELD FERN colored, scaly (at least at base), with 3-7(-9) circular bundles at base and upward. BLADES linear-lanceolate or narrowly lanceolate-oblong, 15-80 cm long, 6-18 cm wide, pinnate-pinnatifid to nearly bipinnate; rachis with a few scales. PINNAE opposite or alternate, 10-20 pairs, lanceolate short-stalked, lowest pair broadly triangular, about as wide as long, shorter than middle pinnae; margins serrate, the teeth somewhat bristle-tipped. VEINS, free, forked, mostly not reaching the margin. SORI not marginal, circular, separate. INDUSIA reniform, often circular but with a sinus, glabrous. SPORES bilateral.

Hybrids between this species and other species of *Dryopteris* are known, notably with *D. intermedia* (*D.* × *boottii*), *D. clintoniana*, *D. marginalis*, and *D. spinulosa*.

Dryopteris fragrans (Linnaeus) Schott Plate 28

FRAGRANT SHIELD FERN, FRAGRANT CLIFF FERN

Thelypteris fragrans

NY (rare), Vt (rare), NH (rare), Me (rare).

Dry or moist shaded cliffs and slopes. Soil acid to neutral, pH mostly 5-7.

RHIZOMES stout, erect, scaly, with old stipe bases and old persistent fronds. FRONDS not dimorphic, clustered, 7-30(-45) cm long, evergreen. STIPE much shorter than blade, straw-colored, densely scaly, with 3-7(-9) circular bundles at base and upward. BLADES linear-lanceolate, 8-25(-35) cm long, 1-6 cm wide, pinnate-pinnatifid to bipinnate, rarely bipinnate-pinnatifid, rachis with few to many scales. PINNAE opposite or alternate, 15-40 crowded pairs, oblong, sessile or short-stalked, with aromatic glandular hairs on upper and lower sides, lowest pair much shorter than middle pinnae; margins crenate but not bristle-tipped. VEINS obscure, free, usually not forked, 2 or 3 pairs per segment, mostly not reaching the margin. SORI not marginal, circular, separate but large (1-2 mm) and close together, chocolate-brown. INDUSIA large, reniform, circular but each with a narrow sinus, margin glandular. SPORES bilateral.

Dryopteris goldiana (W.J. Hooker) A. Gray Plate 29

GOLDIE'S SHIELD FERN, GIANT WOOD FERN

NY, Vt, NH, Me, Mass, Ct, NJ, Pa.

Rich, moist woods and shaded stream banks. Soil about neutral.

RHIZOMES stout, short-creeping, scaly, with old stipe bases. FRONDS not dimorphic, clustered, 50-130 cm long, semi-evergreen. STIPE shorter than blade, straw-colored, densely scaly, with 3-7(-9) circular bundles at base and upward. BLADES triangular to ovate or broad-lanceolate, 25-65 cm long, 20-40(-50) cm wide, pinnate-pinnatifid to bipinnate-pinnatifid golden-green, rachis scaly. PINNAE mostly opposite (at least below), alternate above, 10-20(-35) pairs, lanceolate with short stalks, the lowest pair usually slightly shorter than middle pinnae; margins serrate, teeth with a very short bristle at apex. VEINS free, mostly forked, scaly, most not reaching the margin. SORI not marginal, circular, separate or confluent, golden brown. INDUSIA reniform, circular but with a small sinus. SPORES bilateral.

Hybrids between this species and other species of *Dryopteris* are known, notably with *D. clintoniana* and *D. marginalis*.

Dryopteris celsa (Palmer) Small, LOG FERN, apparently is closely related to *D. goldiana*, although it more closely resembles *D. clintoniana*. It is now generally recognized as a distinct species, having been formerly treated as a subspecies, or a variety, or a form of *D. goldiana*. It is rare and local in our area, being reported from Pennsylvania, New Jersey, and New York. It differs from *D. goldiana* in that the blade color is a uniform, dark green (rather than dark and light areas) and the blade tapers gradually to the tip (rather than abruptly to a short acuminate tip). It differs from *D. clintoniana* in that the lowest pinnae are narrower at base than at middle (rather than wider at base).

Dryopteris intermedia (Muhlenberg) A. Gray Plate 30

FANCY FERN, COMMON WOOD FERN

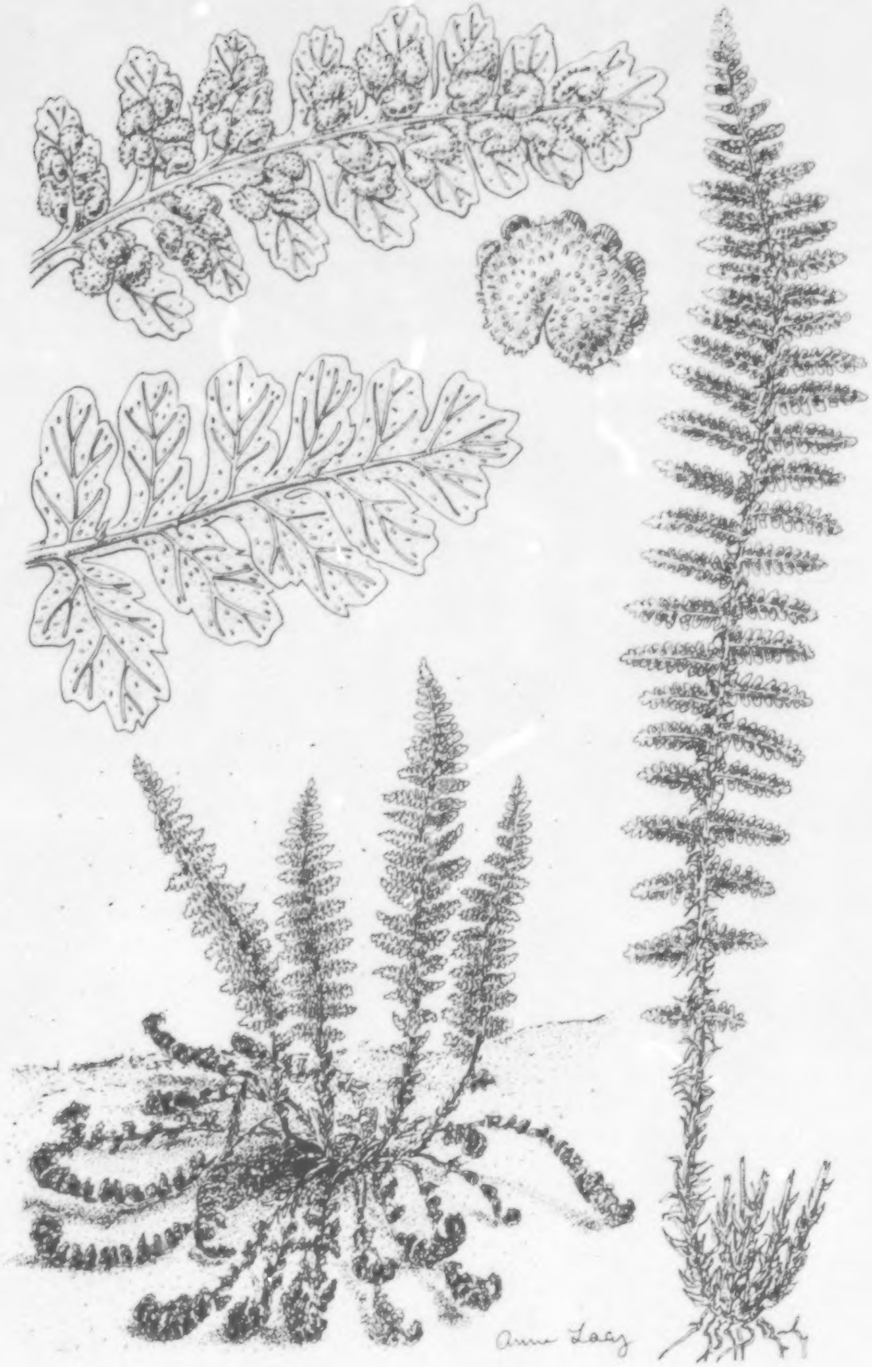
D. austriaca var. *intermedia*, *D. spinulosa* var. *i.*

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Moist woods, rocky slopes, hummocks in swamps. Soil acid to neutral, pH usually 5-7.

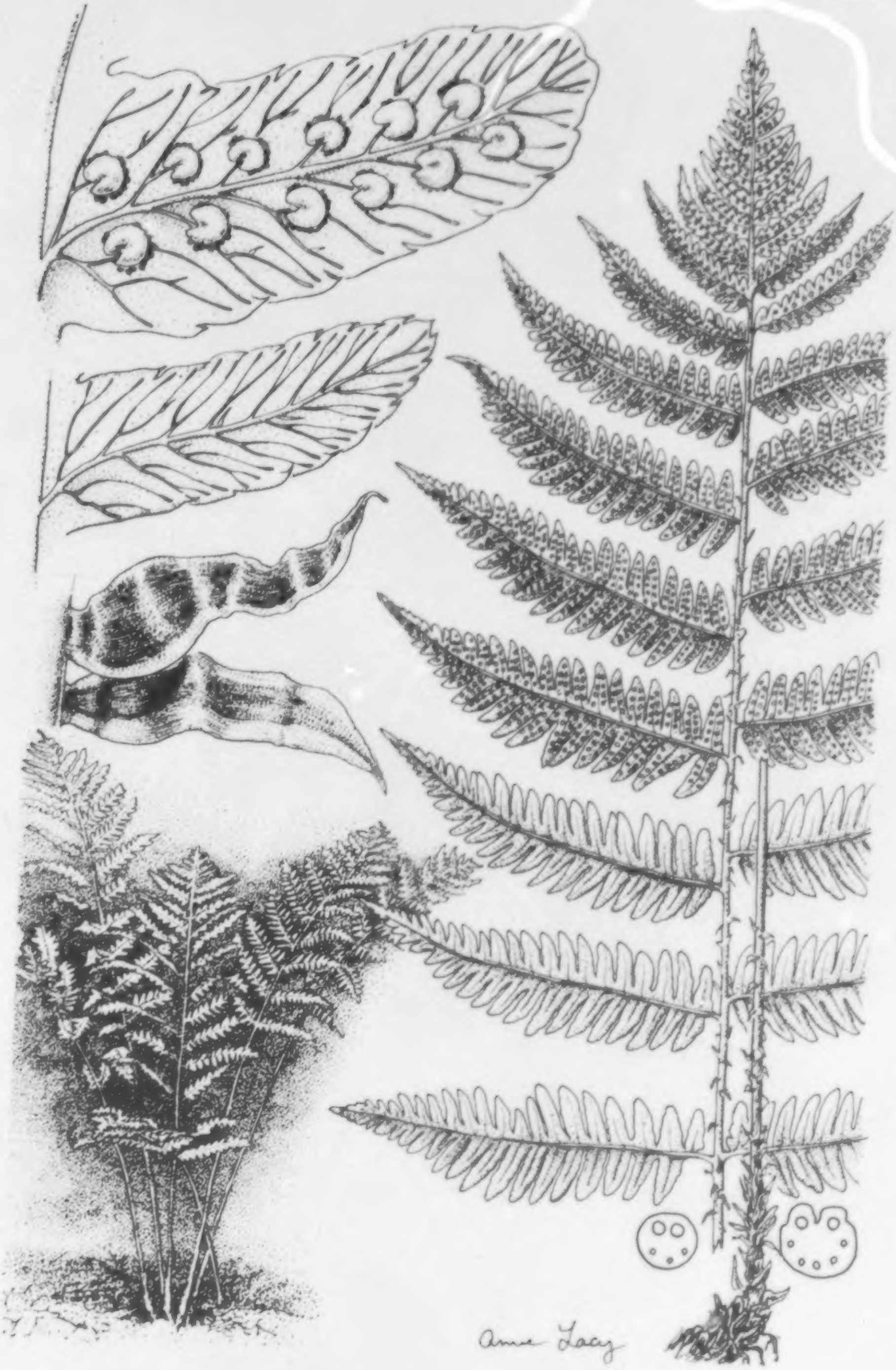
RHIZOMES stout, nearly erect, scaly, with old stipe bases. FRONDS not dimorphic, clustered, 20-75 cm long, evergreen. STIPE shorter than blade, straw-colored, with hairs and scales, with 3-7(-9) circular bundles at base and upward. BLADES oblong-lanceolate, 25-50 cm long, 13-25(-30) cm wide, bipinnate-pinnatifid to tripinnate; rachis with glandular hairs (except on overwintered evergreen blades). PINNAE opposite or nearly so, 10-20(-30) pairs, lanceolate, lowest pair obliquely ovate and about same length as middle pinnae, midveins with hairs. PINNULES oblong-lanceolate, second from the rachis on the lowest pinna usually the longest, with hairs; margins with bristle-tipped teeth. VEINS free, forked, mostly not reaching the margin. SORI not marginal, circular, separate. INDUSIA reniform, often circular, but with a sinus, with glandualr hairs which may disappear with age. SPORES bilateral.

Plate 28



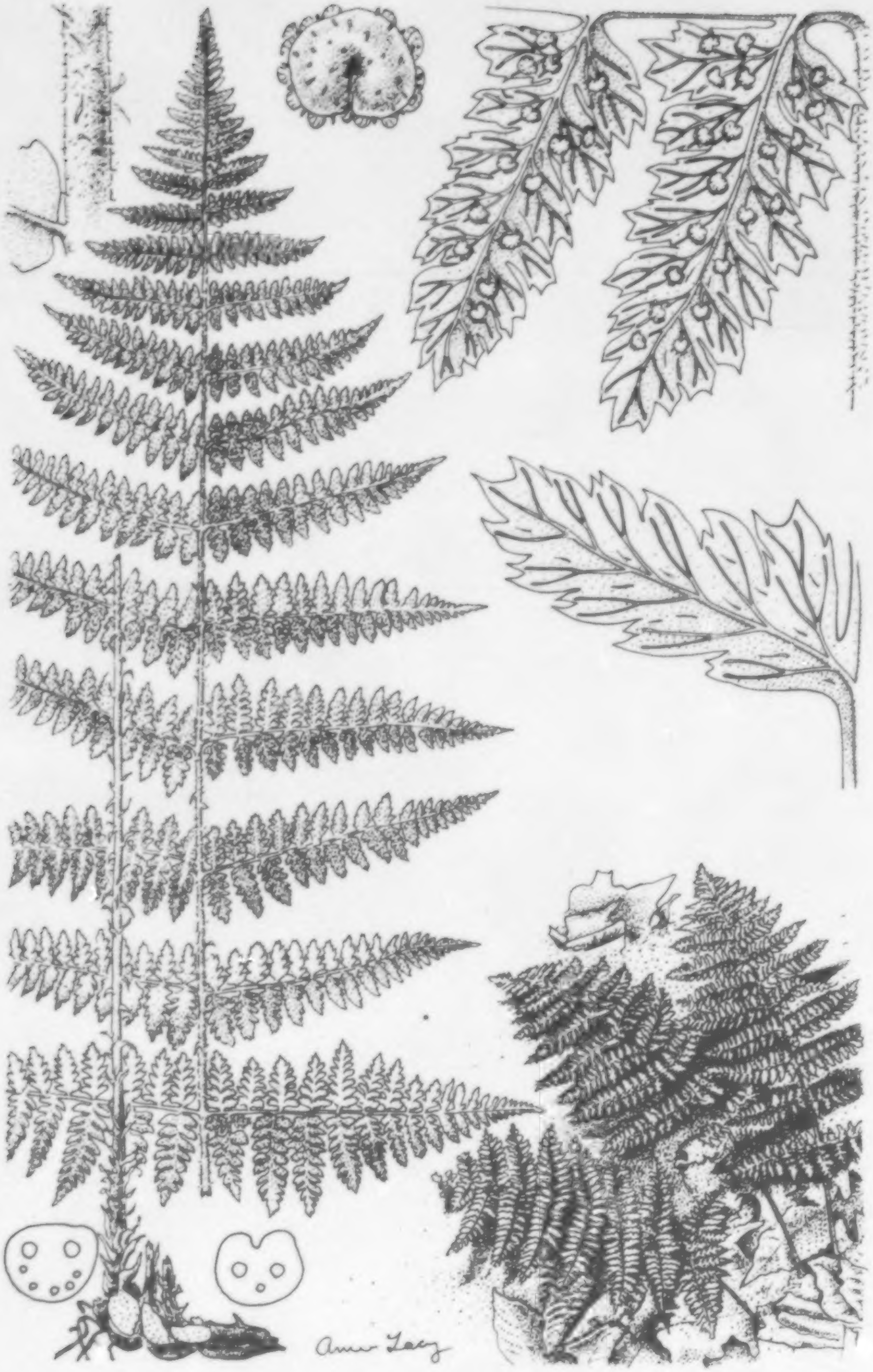
Dryopteris fragrans FRAGRANT SHIELD FERN

Plate 29



Dryopteris goldiana GOLDIE'S SHIELD FERN

Plate 30



Dryopteris intermedia FANCY FERN

This is our only species of *Dryopteris* with hairs on the stipe and rachis, although *D. marginalis* may have some scales that are slender and hair-like on the underside of the rachis. A common fertile hybrid (*D. cristata* × *intermedia*) also has the glandular hairs. It may be called *D.* × *boottii*. *D. intermedia* also hybridizes with other species of *Dryopteris*, notably with *D. spinulosa*.

Dryopteris marginalis (Linnaeus) A. Gray Plate 31

MARGINAL SHIELD FERN, EVERGREEN WOOD FERN

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Rocky woods, shaded ledges, talus slopes, clay banks, sometimes hummocks in swamps. Soil variable, often sterile, mostly acid but also neutral or slightly alkaline.

RHIZOMES stout, erect, scaly, with old stipe bases. FRONDS not dimorphic, clustered, (15-)35-100 cm or more long, evergreen. STIPE shorter than blade, straw-colored, densely scaly, with 3-7(-9) circular bundles at base and upward. BLADE ovate-oblong to lanceolate, 25-50(-75) cm long, (5-)10-25 cm wide, pinnate-pinnatifid to bipinnate, rarely bipinnate-pinnatifid; rachis with scales (some may be slender and hair-like) on the underside. PINNAE opposite or alternate, 15-20 pairs, oblong to lanceolate, short-stalked, the lowest pair usually slightly shorter than middle pinnae. PINNULES oblong, obtuse, glabrous; margins with obscure teeth which are not bristle-tipped. VEINS free, forked, mostly not reaching the margin. SORI near the pinnule margin, circular, separate. INDUSIA reniform, often circular but each with a sinus. SPORES bilateral.

Fruiting fronds easily distinguished from our other species of *Dryopteris* by the submarginal position of the sori. Hybrids between this species and other species of *Dryopteris* are known, notably with *D. cristata*, *D. goldiana*, and *D. spinulosa*.

Dryopteris filix-mas (Linnaeus) Schott, MALE FERN, rare in Vermont and Maine, is similar to *D. marginalis* but its sori are not marginal and it usually has more than 20 pairs of pinnae, the lowest pair being much shorter than the middle pinnae.

Dryopteris spinulosa (O. F. Mueller) Watt Plate 32

SPINULOSE SHIELD FERN, EVERGREEN WOOD FERN

D. austriaca var. *spinulosa*

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Wet woods, swamps, moist rocky slopes. Soil usually acid, pH mostly 5-6.

RHIZOMES stout, creeping, scaly, with old stipe bases. FRONDS not dimorphic, clustered, 25-65(-100) cm long, evergreen or nearly so, especially the sterile fronds. STIPE shorter than blade, straw-colored, scaly, with 3-7(-9) circular bundles at base and upward. BLADES lanceolate, (10-)20-45(-60) cm long, (6-)15-25 cm wide, bipinnate or bipinnate-pinnatifid to nearly tripinnate; rachis with a few scales. PINNAE opposite or alternate, ascending, 10-20(-30) pairs, lowest pair obliquely triangular and about same length as middle pinnae. PINNULES lanceolate, acute at apex, the one closest to the rachis on the lower side of the lowest pinna longer than the other pinnules and two to three times as long as the opposing pinnule, segments oblong, obtuse, glabrous; margins with bristle-tipped teeth. VEINS free, forked, mostly not reaching the margin. SORI not marginal, circular, separate. INDUSIA reniform, often circular but with a sinus, glabrous. SPORES bilateral.

Hybrids between this species and other species of *Dryopteris* are known, notably with *D. cristata*, *D. intermedia*, and *D. marginalis*.

Gymnocarpium dryopteris (Linnaeus) Newmann Plate 33

OAK FERN

Phegopteris dryopteris, *Thelypteris dryopteris*, *Dryopteris disjuncta*

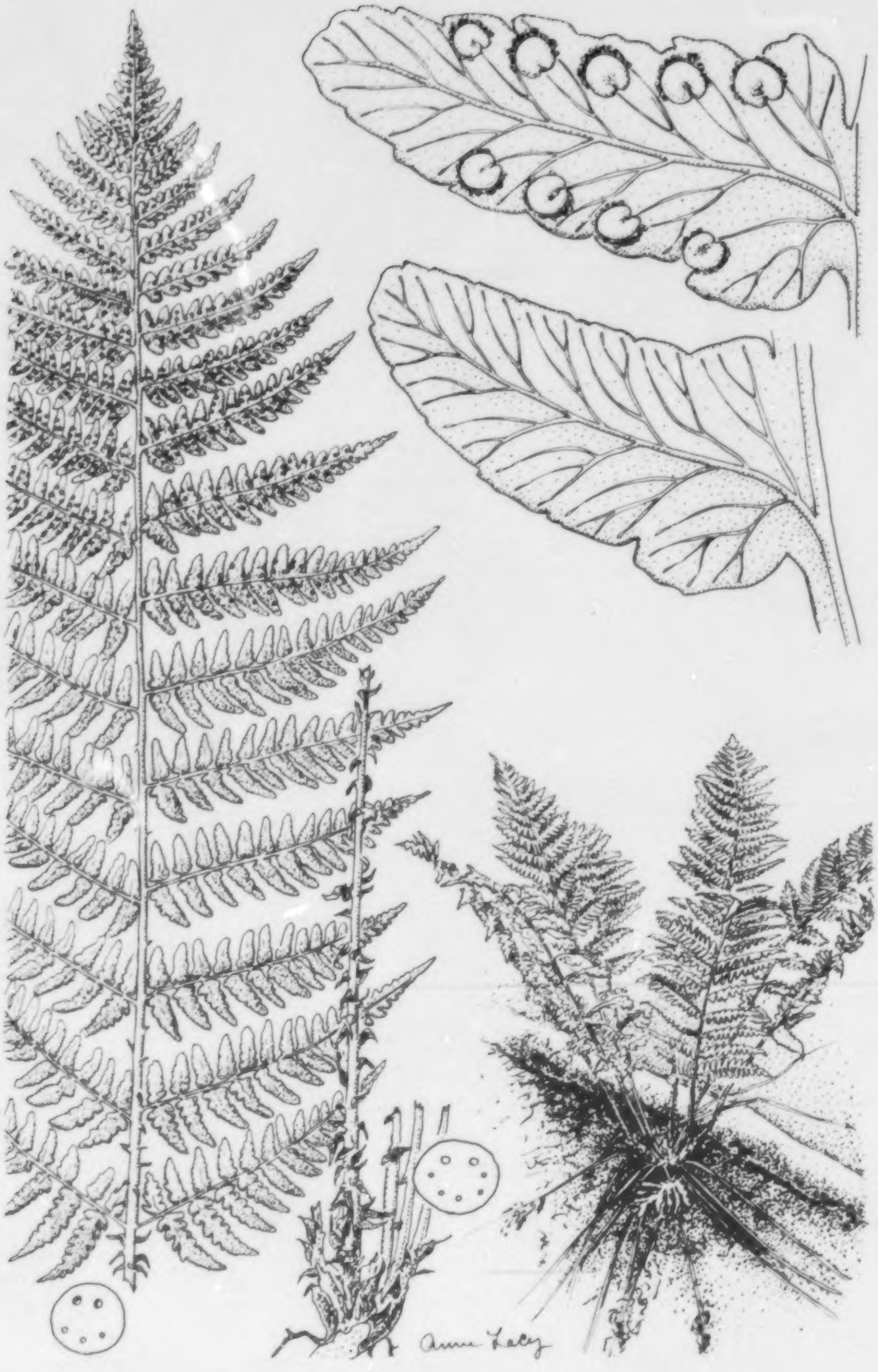
NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Moist woods, swamp margins, often under conifers. Soil usually acid, pH mostly 5-6.

RHIZOMES branched, blackish, 1-1.5 mm in diameter, scaly. CROZIERS small, green, 3 in a group. FRONDS not dimorphic, coming from separate points on the rhizome, (8-)13-45(-60) cm long, not evergreen. STIPE slender, longer than the blade, glabrous, with a few scales at base, with 2 circular or oval bundles at base and upward. BLADES triangular to triangular-pentagonal (ternate, each third triangular), 7-20 cm long, 10-25 cm wide, bipinnate-pinnatifid to tripinnate-pinnatifid, borne at a right-angle to the stipe and thus horizontal; rachis delicate, green, glabrous. PINNAE opposite, 5 or more pairs, lowest pair longest and divided into pinnules; only the lowest pair of pinnae with stalks. PINNULES oblong, pinnatifid, opposite, glabrous; margins entire or crenate. VEINS free, mostly not forked, reaching the margin, 2-6 pairs per segment. SORI near the margin, circular, separate, sometimes becoming contiguous at maturity. INDUSIA absent. SPORES bilateral.

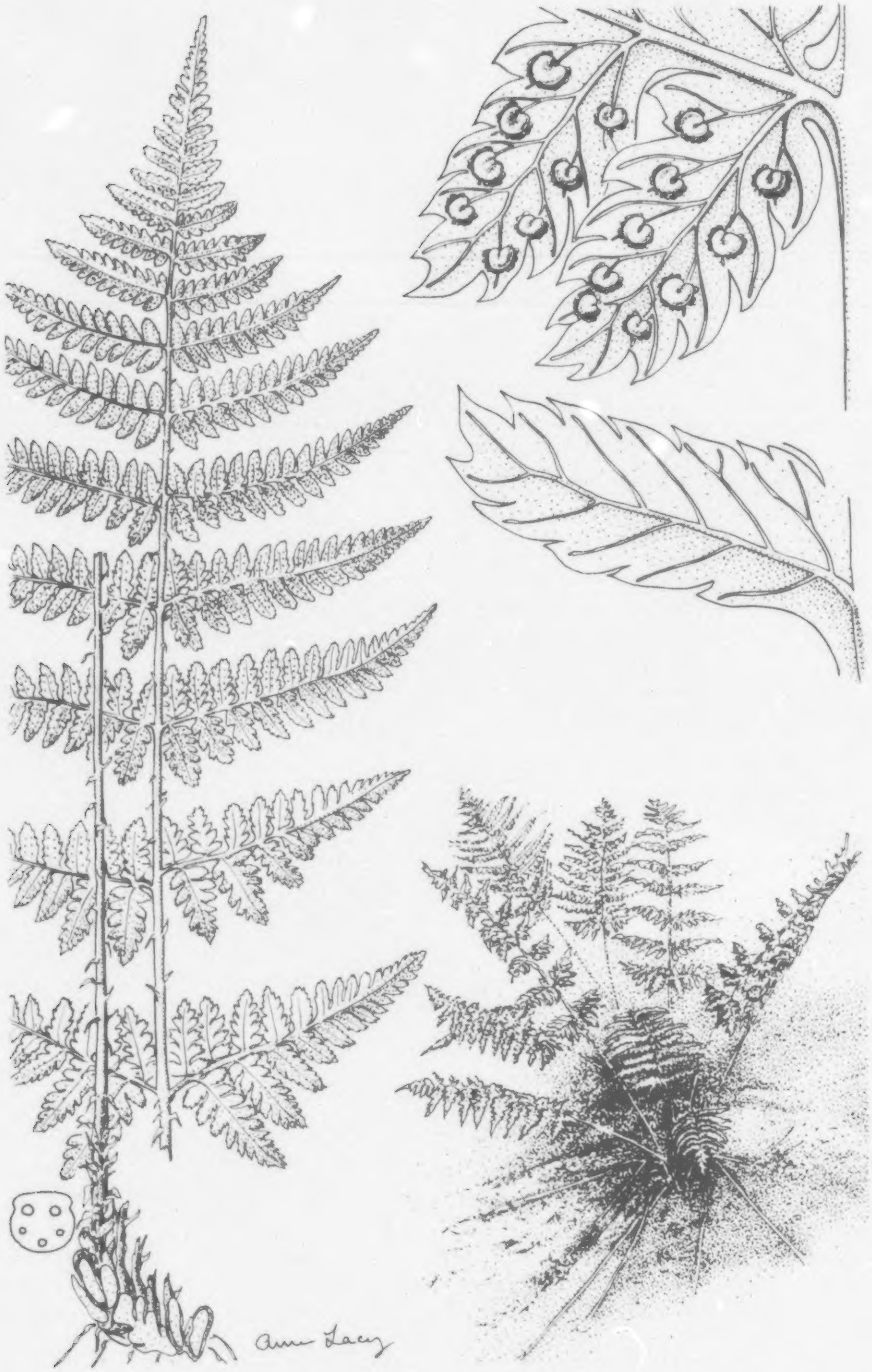
Gymnocarpium robertianum does not occur in our area, except for a single disjunct station in Pennsylvania. It differs from *G. dryopteris* in having the lowest two pairs of pinnae with stalks and the blade with many short glandular hairs.

Plate 31



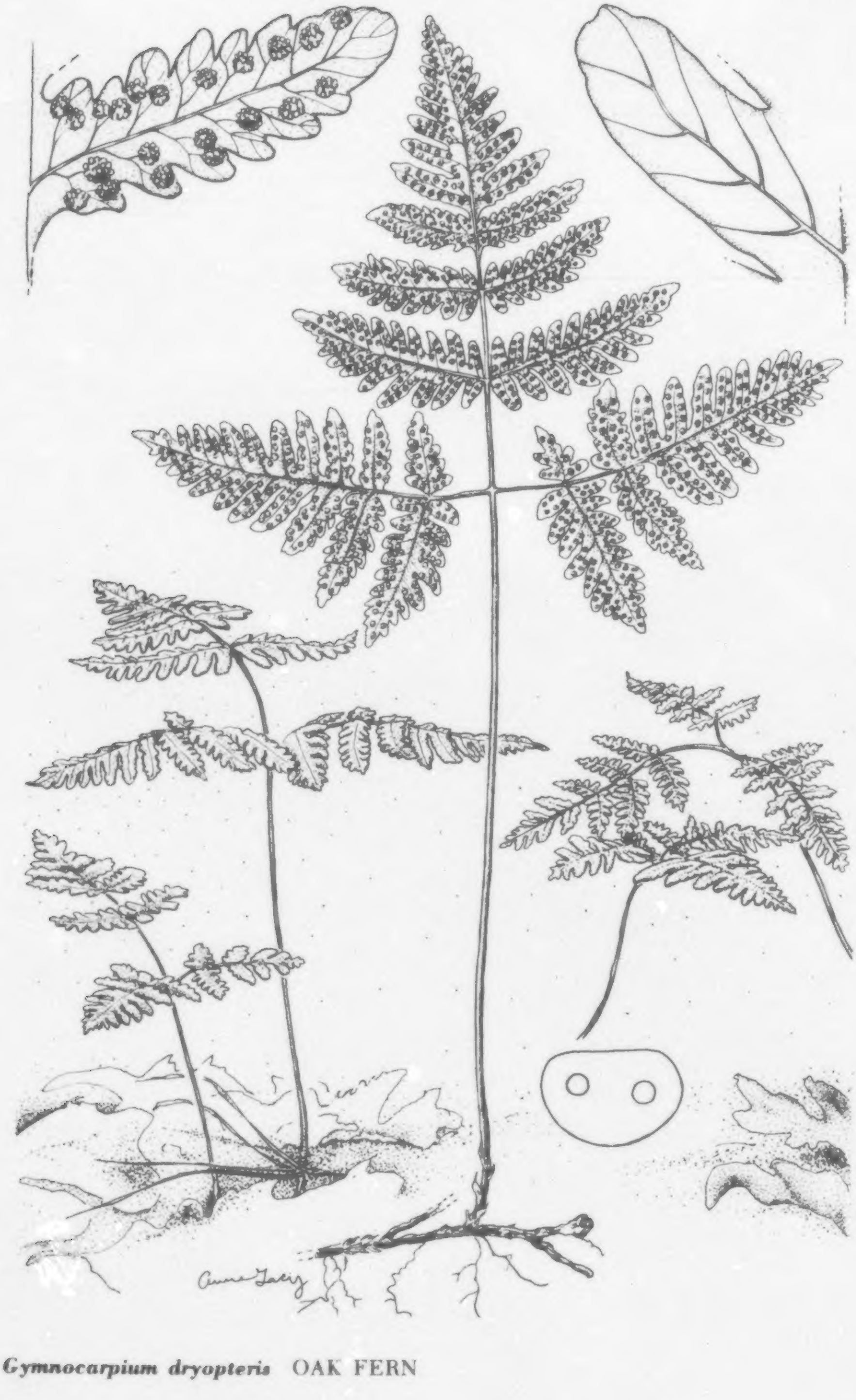
Dryopteris marginalis MARGINAL SHIELD FERN

Plate 32



Dryopteris spinulosa SPINULOSE SHIELD FERN

Plate 33



Gymnocarpium dryopteris OAK FERN

Lorinseria areolata (Linnaeus) Presl Plate 34

NETTED CHAIN FERN, NARROW-LEAVED CHAIN FERN

Woodwardia areolata

NY (southeast), NH (rare), Me (rare, no voucher), Mass, Ct., RI, NJ, Pa.

Swamps, wet woods, bog margins, shallow water, can grow in full sun. Soil very acid.

RHIZOMES slender, creeping, 3-3.5(-4) mm in diameter, scaly. CROZIERS appear late spring, densely covered with light-brown scales. FRONDS dimorphic, borne singly from points on the rhizome, but may be in mass because of intricate growth of rhizomes, 30-80 cm long, fertile fronds usually longer than sterile fronds, not evergreen. STIPE about same length as blade, 1-5 mm wide, with a few scales, sterile straw-colored or greenish, fertile brown-purple to blackish, with 2 circular or linear curved bundles. STERILE BLADES triangular-ovate, 15-40 cm long, (6-)10-17(-20) cm wide, mostly deeply pinnatifid but often pinnate at base; rachis with a few scales. STERILE PINNAE (or segments) 7-10 pairs alternate, linear-lanceolate to oblong-lanceolate, lower and middle pinnae about same length, glabrous, with a few scales; margins entire to serrulate. VEINS reticulate, only the outer ones free and reaching the margin. FERTILE BLADES essentially pinnate with narrowly linear pinnae, stipe as long or longer than the blade. SORI not marginal, linear or linear-oblong, 4-8 mm long, not confluent (at least when young). INDUSIA laterally attached, inconspicuous when young, opening toward the midvein. SPORES bilateral.

Sterile fronds are similar to those of *Onoclea sensibilis*, but they can be distinguished by their alternate pinnae and serrulate margins.

Lygodium palmatum (Bernhardi) Swartz Plate 35

CLIMBING FERN, HARTFORD FERN

NY (rare), Vt (rare), NH (rare), Mass (rare), Ct (rare), RI (rare), NJ, Pa.

Moist woods, wet slopes, boggy places. Can grow on sandy soil but requires water around the roots. Soil very acid, pH 4-5.

RHIZOMES branched, black, about 1 mm in diameter, without scales, with a few septate hairs. FRONDS dimorphic, divided into sterile and fertile parts, usually 40-100 cm long, climbing. STIPE shorter than the blade portion, about 1 mm in diameter, with 1 bundle. STERILE PINNAE alternate, each divided into two stalked pinnules. STERILE PINNULES palmately lobed, 2-4 cm long, 2-7 cm wide, glabrous, on stalks 1-2 cm long; margins entire. VEINS free, forked several times. FERTILE PINNAE above the sterile pinnae, several times dichotomously branched, the ultimate segments 3-5 mm long, 1-2 mm wide. SORI in a double row on the segments. INDUSIA only the pinnule margins modified to laterally attached, overlapping scales. SPORES tetrahedral.

This is our only fern with the twining habit.

Marsilea quadrifolia Linnaeus Plate 36

WATER CLOVER, PEPPERWORT

NY (rare), Me (rare), Mass, Ct, NJ, Pa. Introduced from Europe.

Shallow water, rooted in mud. Soil mostly neutral.

RHIZOMES elongate, slightly branched, 0.5-0.8 mm in diameter, glabrous or with hairs, without scales. FRONDS to 40 cm long, depending on water depth. STIPE much longer than blade. BLADES floating, submerged or emergent, palmate, with 4 pinnae. PINNAE obovate or triangular, 0.8-2.7 cm long and wide, nearly glabrous; margins entire or nearly so. VEINS forking with many cross-veins. SPOROCARPS on stalks attached to the stipe near its base, usually 2 per stalk, 4-5 mm long, 3-3.5 mm wide, with yellowish hairs when young, glabrous or nearly so when mature. SORI with several sporangia in two rows within each sporocarp. INDUSIA delicate. SPORES tetrahedral, of two sizes, each sporangium with many microspores or with one macrospore.

This plant may become weedy, even in pools that become dry for periods of time, since the hard-walled sporocarps persist as propagules.

Matteuccia struthiopteris (Linnaeus) Todaro Plate 37

OSTRICH FERN

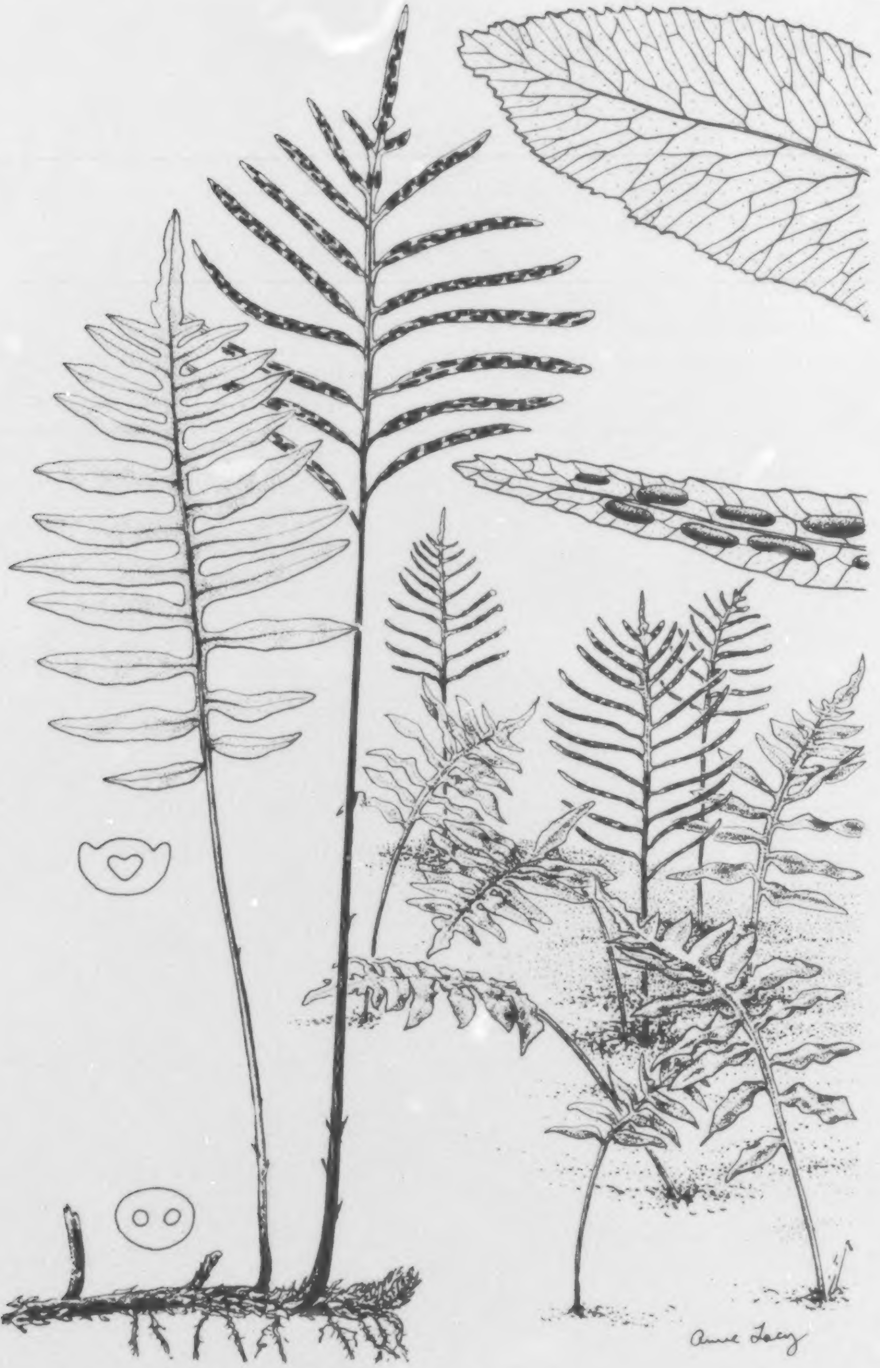
M. pensylvanica, Pteretis nodulosa, Pteretis pensylvanica

NY, Vt, NH, Me, Mass, Ct, RI (rare), NJ, Pa.

Rich, alluvial soil along streams, moist woods. Soil neutral or nearly so.

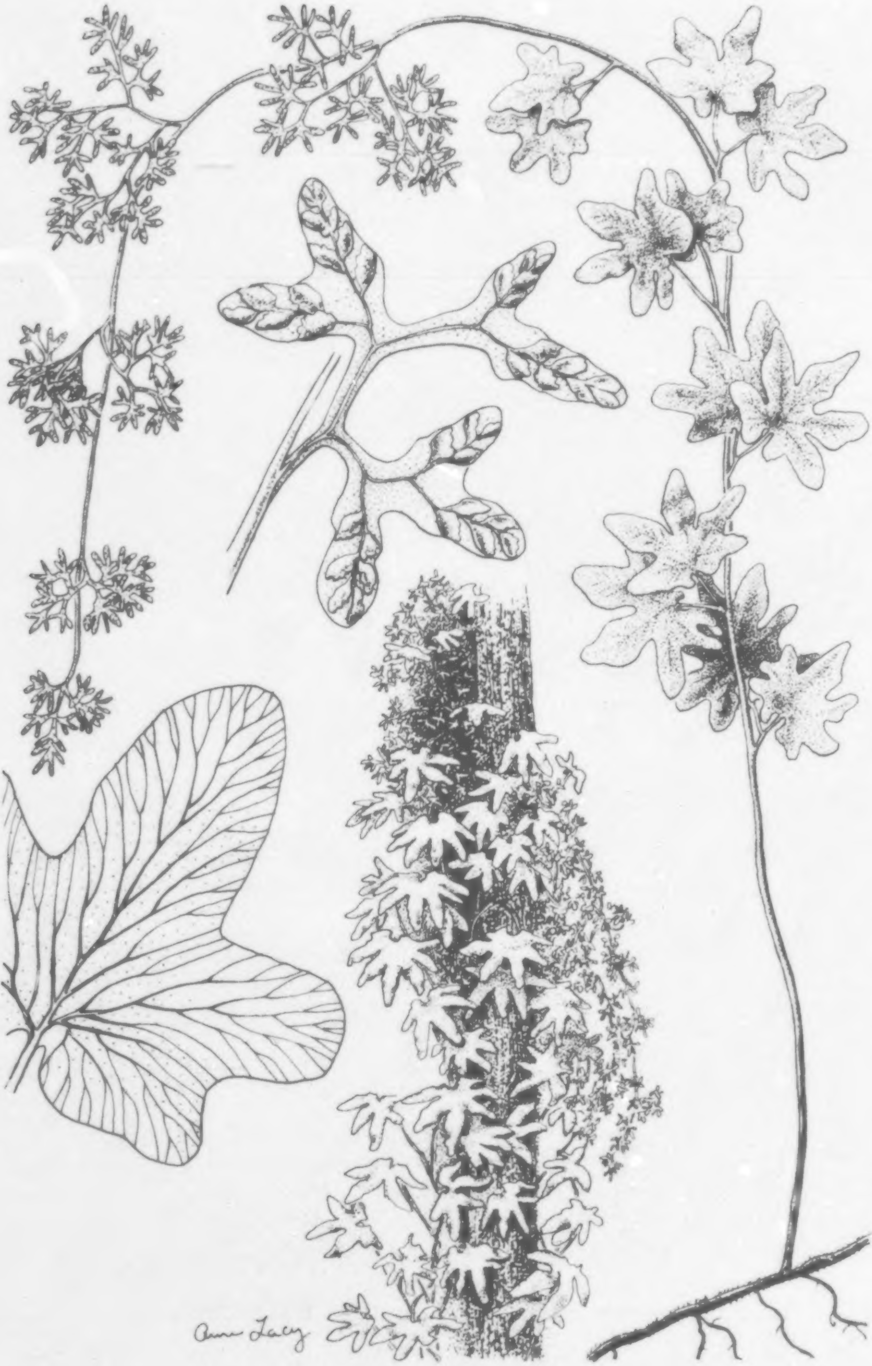
RHIZOMES stout, erect, branched, scaly. CROZIERS 2-4 cm wide, green with deciduous light brown scales. FRONDS dimorphic, several in a cluster, not evergreen. Sterile fronds 45-100 (-300) cm long. Fertile fronds shorter than sterile, 30-70 (-100) cm long, plumose, remaining upright in winter. STIPE of sterile frond green, much shorter than blade, 6-40 cm long, 2-6 mm wide, each deeply grooved on one side, with 2 linear bundles at base which may be united upward. STIPE of fertile frond similar but about same length as blade. STERILE BLADES elliptic, 50-100 cm long, (12-)15-35(-60) cm wide, pinnate-pinnatifid; rachis with whitish hairs. STERILE PINNAE 20 or

Plate 34



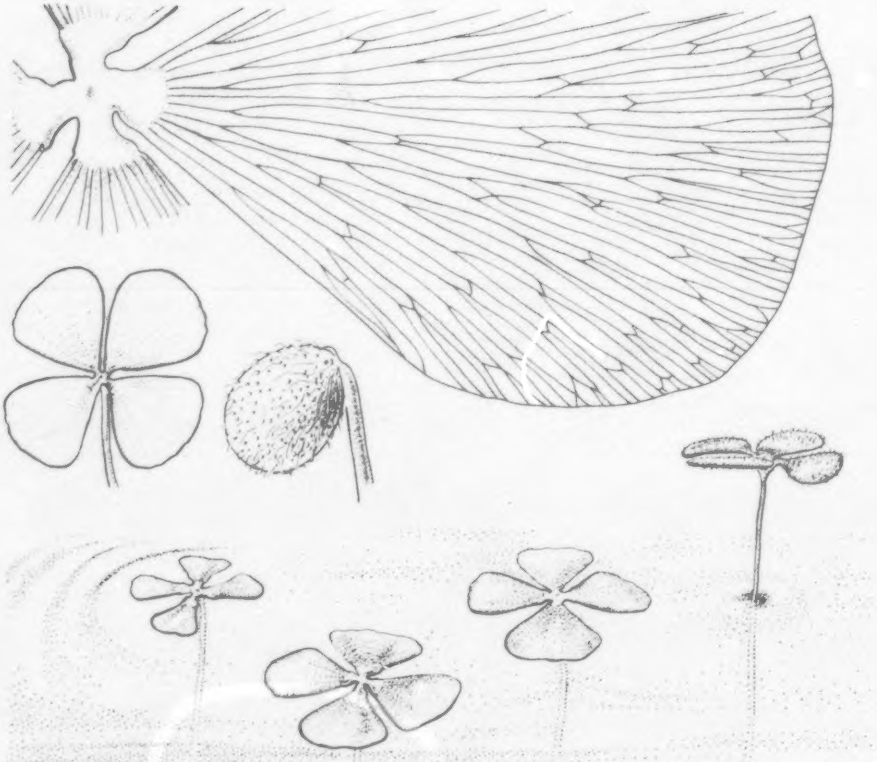
Lorinseria areolata NETTED CHAIN FERN

Plate 35



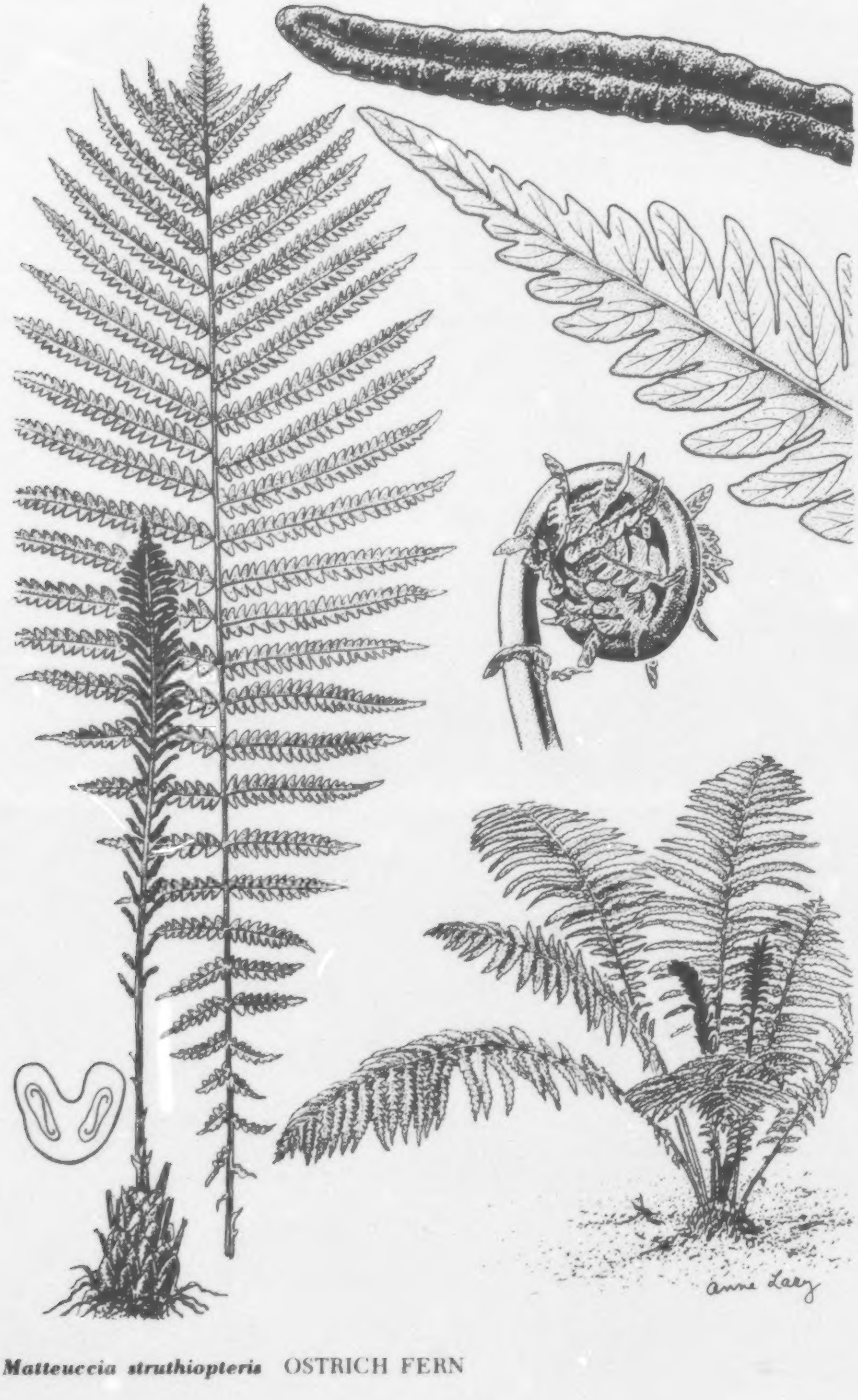
Lygodium palmatum CLIMBING FERN

Plate 36



Marsilea quadrifolia WATER CLOVER

Plate 37



Matteuccia struthiopteris OSTRICH FERN more pairs, alternate, long-acuminate, sessile, lowest pinnae much shorter than middle pinnae; margins finely denticulate to nearly entire. VEINS of sterile pinnae free, not forked, reaching the margin, 7-9 pairs per segment. FERTILE BLADES elliptic, 15-30 cm long, 5-8 cm wide, pinnate, dark green to blackish, drying to brown. SORI several on a segment, inrolled in the margins. INDUSIA hoodlike, lacerate to ray-like. SPORES bilateral.

Onoclea sensibilis Linnaeus Plate 38

SENSITIVE FERN, BEAD FERN

NY, Vt, NH, Me, Mass, CT, RI, NJ, Pa.

Swamps, marshes, moist meadows. Tolerates full sun. Soil neutral to acid, pH often 5-6.

RHIZOMES slender, branched, mostly 3-5 mm in diameter, with a few scales. FRONDS dimorphic, borne singly from points on the rhizome. Sterile fronds mostly 50-130 cm long, not evergreen, turning brown during late summer and early fall, even before frost. Fertile fronds shorter than sterile fronds, not evergreen but persistent and erect during winter, sometimes for 2 or 3 years. STIPE longer than blade, 15-65 cm long, 1-4 mm wide, buff to brown, glabrous, with a few scattered scales at base and sometimes hemispherical in cross section upward, shallowly grooved, each with 2 linear, slightly curved bundles at base which are united upward. STERILE BLADES broad-triangular, (10-)15-35(-40) cm long, (10-)20-40 cm wide, pinnatifid above to pinnate or pinnate-pinnatifid below; rachis winged, especially upward. STERILE PINNAE 2-16 pairs, usually opposite or nearly so, oblong-lanceolate, upper ones sessile, lower ones with stalks, lower pinnae longer than middle pinnae, glabrous on upper side, with a few septate, white hairs on underside; margins entire, sinuate or pinnatifid. VEINS reticulate, outer ones free and reaching the margin. FERTILE BLADES lanceolate to ovate or elliptic, bipinnate, dark brown with buff rachises. SORI circular to oblong, 3-5 per segment, inside globose leaf-balls which are 1-4 mm in diameter. INDUSIA lateral, hoodlike, opening toward the veins, somewhat leathery but withering early. SPORES bilateral.

Sterile fronds are similar to those of *Lorinseria areolata*, but they can be distinguished by the opposite pinnae and entire margins. Fronds intermediate between sterile and fertile ones are sometimes found, especially where the rhizome has been injured.

Ophioglossum vulgatum Linnaeus Plate 39

ADDER'S-TONGUE

O. pseudopodum, O. pycnostichum

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Moist meadows, damp woods, boggy places. Soil variable but mostly acid, pH usually 5-7.

RHIZOMES erect, bearing many fleshy roots and one to several fronds. FRONDS dimorphic, scattered, erect or bent in the bud (no croziers formed), 7-36 cm long, divided into sterile (below) and fertile (above) portions. STIPES (1.5-)6-13(-19) cm long, fleshy, green, with 3-6 obscure bundles at base which unite upward. STERILE BLADES oval to ovate, (1-)4-8(-12) cm long, (1-)2-3(-5) cm wide, sessile, not dissected, glabrous. VEINS reticulate. FERTILE BLADES linear-cylindric, 1-4 cm long, 0.2-0.5 cm wide. SORI of two rows of spherical sporangia, green when young. SPORES tetrahedral, spherical, sulfur-yellow.

This taxon may include two species in our area and is so treated by some authors.

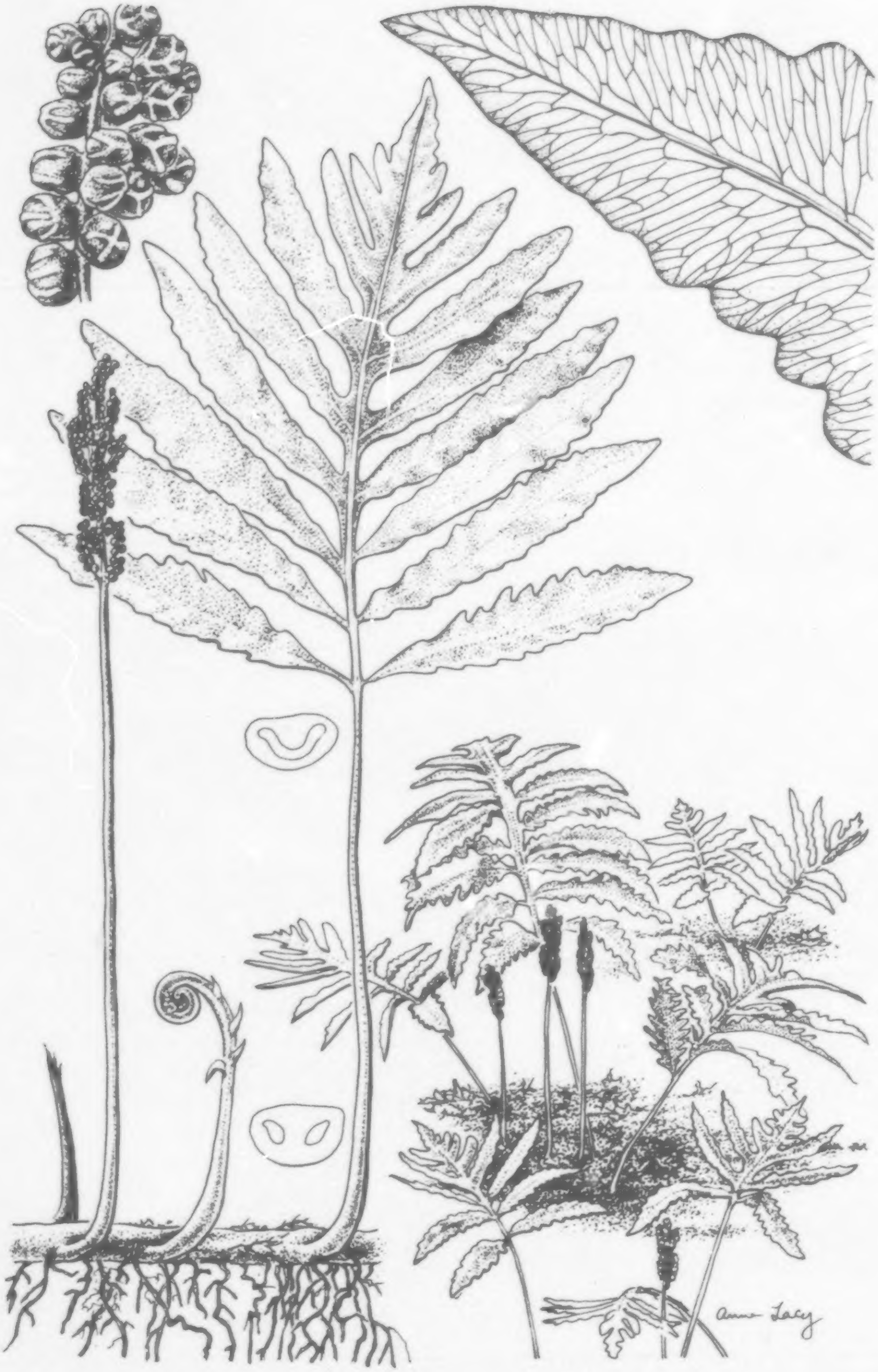
Osmunda cinnamomea Linnaeus Plate 40

CINNAMON FERN

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

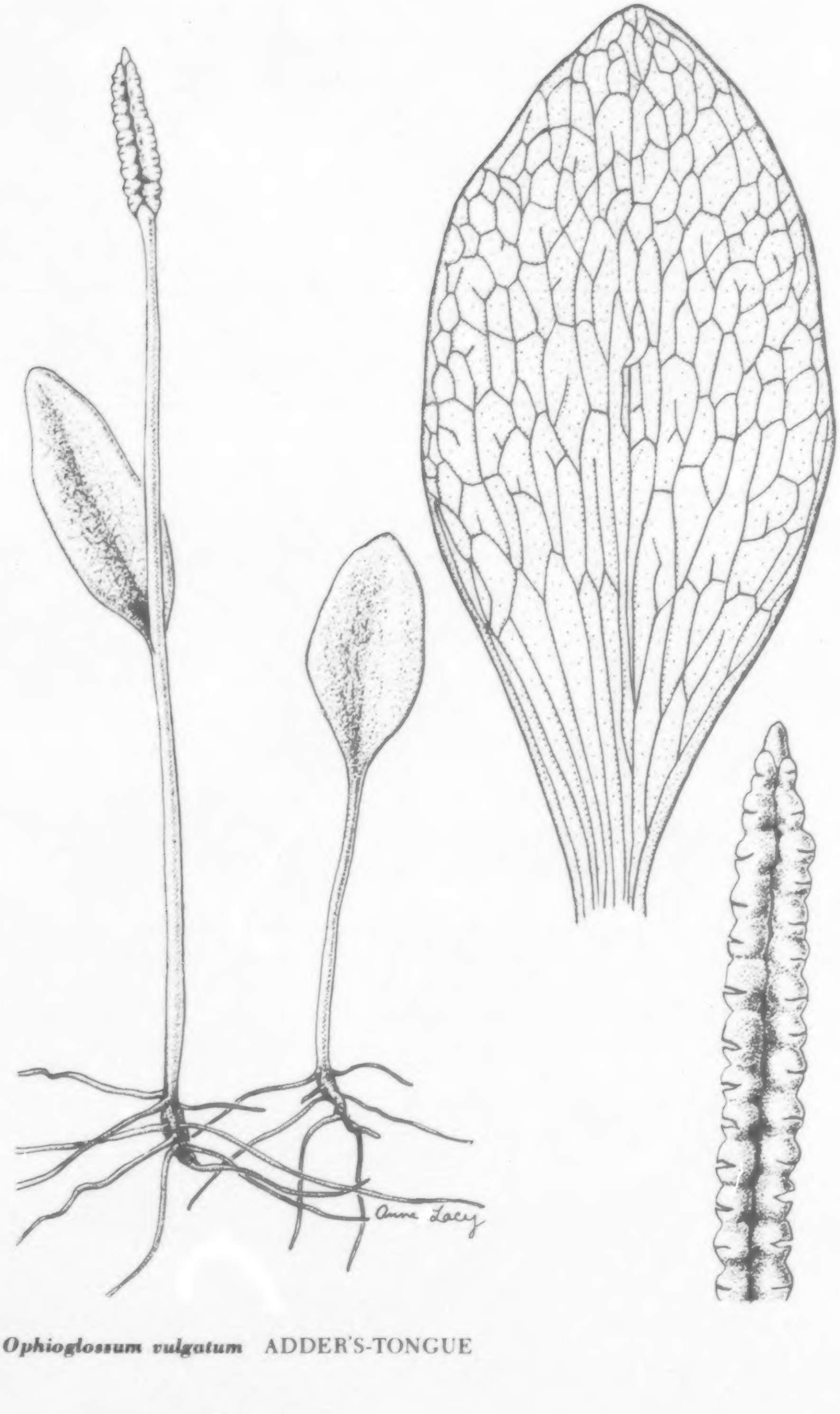
Swamps, wet woods, boggy places, wet meadows. Soil acid, pH usually 4-6.

RHIZOMES large, short, without scales but covered with old roots and winged stipe bases. CROZIERS circular, about 2 cm in diameter, densely covered with whitish hairs which become cinnamon-brown. FRONDS dimorphic, clustered, 50-100 cm or more long, not evergreen. Fertile fronds surrounded by sterile fronds. STIPE of sterile fond shorter than the blade, 2-4.5 mm wide, greenish or pinkish, covered with cinnamon-brown hairs, without scales, with 1 horseshoe-shaped bundle that is much curled in at the ends. STERILE BLADES oblong-lanceolate to linear-lanceolate, 35-100 cm long, 13-25(-30) cm wide, pinnate-pinnatifid to nearly bipinnate; rachis hairy when young, becoming glabrous with age, except for a tuft of brownish hairs at the base of each pinna. STERILE PINNAE 15-25 pairs, alternate or opposite, oblong-lanceolate, mostly sessile, lowest pair shorter than middle ones. STERILE PINNULES (segments) 15-20 pairs on longest pinnae, apex obtuse or acutish, glabrous or with a few hairs, without scales; margins entire. VEINS of sterile pinnae free, forked, reaching the margin, 9-12 pairs per segment. FERTILE BLADES completely fertile, narrowly lanceolate to linear, 17-40 cm long, bipinnate, bright green when young, cinnamon-brown in age. SORI short-stalked, spherical, in clusters, confluent. INDUSIA absent. SPORES triplanate, spherical, green.

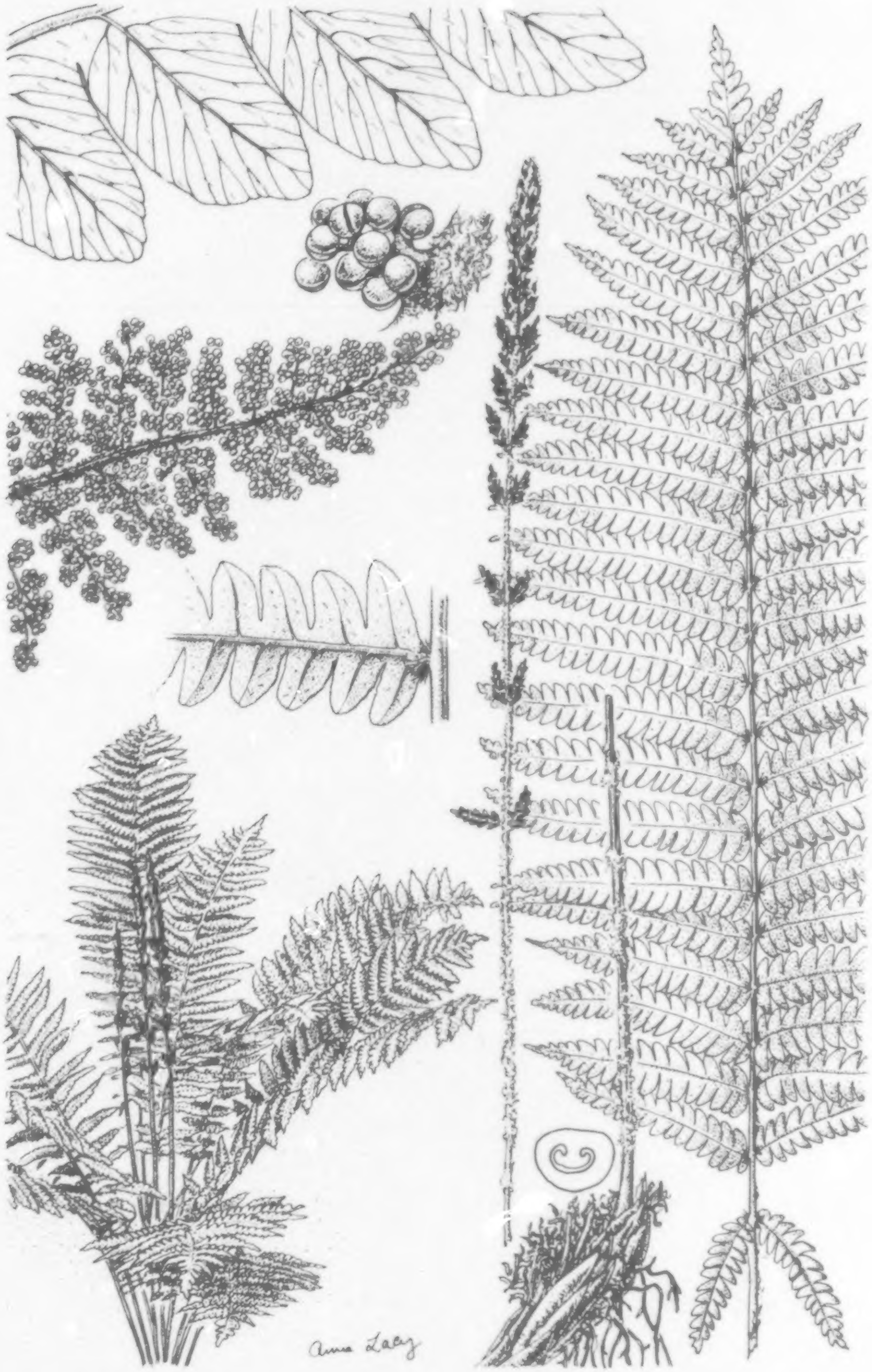


Onoclea sensibilis SENSITIVE FERN

Plate 39



Ophioglossum vulgatum ADDER'S-TONGUE



Osmunda cinnamomea CINNAMON FERN

Osmunda claytoniana Linnaeus Plate 41

INTERRUPTED FERN

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Moist woods, swamp margins, ditches, wet or dry meadows. Fertile fronds more often in open areas. Soil acid to neutral, pH mostly 5-7.

RHIZOMES large, creeping, without scales but covered with old roots and winged stipe bases. CROZIERS circular, about 2 cm in diameter, densely covered with whitish hairs when young, becoming brownish. FRONDS dimorphic, clustered, 40-180 cm long, sterile longer than the fertile, not evergreen. STIPE shorter than the blade, 2-5 mm wide, greenish or yellowish, hairy when young, becoming glabrous with age, with 1 horseshoe-shaped bundle that is much curled in at the ends. STERILE BLADES elliptic-oblong to broadly lanceolate, 45-90 cm long, 15-30 cm wide, pinnate-pinnatifid to nearly bipinnate; rachis with a few hairs (at least when young) but no tufts at the pinna bases. FERTILE BLADES differ only in that 1-3(-6) pairs of medial pinnae are replaced by fertile pinnae, covered with clusters of sporangia. STERILE PINNAE (on sterile and fertile blades) 10-25 pairs, alternate or opposite, oblong-lanceolate, mostly sessile, ascending, lowest pair shorter than middle ones. PINNULES (segments) 10-20 pairs on longest pinnae, apex obtuse, glabrous or with a few hairs, without scales; margins entire. VEINS free, forked, reaching the margin, 9-13 pairs per segment. SORI short-stalked, spherical, in clusters, confluent. INDUSIA absent. SPORES triplanate, spherical, green.

Osmunda regalis Linnaeus Plate 42

ROYAL FERN, FLOWERING FERN

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Low woods, marshes, swamps. Soil usually very acid but sometimes nearly neutral, pH mostly 4-6.

RHIZOMES large, short, woody, erect to suberect, without scales but with old roots and stipe bases. CROZIERS densely covered with brown hairs when young, soon becoming glabrous, reddish. FRONDS dimorphic, clustered, 50-180(-350) cm long, not evergreen. STIPE shorter than or about the same length (sometimes longer) as the blade, 2.5-5 mm wide, greenish or straw-colored or reddish, without hairs or scales, with 1 horseshoe-shaped bundle that is much curled in at the ends. BLADES with sterile pinnae below and fertile pinnae above, broad-ovate or broad-elliptic, (20-)25-75(-150) cm long, (15-)25-40(-55) cm wide, bipinnate; rachis with hairs, without scales. STERILE PINNAE opposite or nearly so, (2-)5-7 pairs, oblong to ovate-lanceolate, with short stalks, 15-30 cm long, 5-15 cm wide, lowest pair slightly shorter than middle ones. PINNULES 7-10 pairs, alternate or subopposite, oblong, sometimes slightly auriculate, sessile or with a short stalk, without hairs or scales; margins serrulate to nearly entire. VEINS free, forked, reaching the margin. SORI in short-stalked clusters. INDUSIA absent. SPORES triplanate, spherical, green when young.

A hybrid, *O. claytoniana* × *regalis*, has been found in Connecticut.

Pellaea atropurpurea (Linnaeus) Link Plate 43

PURPLE CLIFF BRAKE

NY, Vt, Mass, Ct, RI (rare), NJ, Pa.

Ledges and talus slopes, mostly on limestone, sometimes on cement walls. Soil neutral to alkaline.

RHIZOMES short, branched, scaly. FRONDS usually distinctly dimorphic, clustered, 8-45 cm long, evergreen. STIPE about 1/2 to 2/3 as long as blade, (1-)5-25 cm long, wiry, purplish or reddish, shiny, rough-hairy or nearly glabrous, with 1 linear, curved bundle. BLADES leathery, grayish green, triangular-ovate to oblong or lanceolate, 10-20(-35) cm long, 5-10(-20) cm wide, pinnate above, bipinnate below; rachis with rough hairs, dark brown. PINNAE 5-11 pairs, opposite or nearly so, lowest pair as long as pair above (or longer) with 1-9 pinnules. PINNULES ovate, sometimes triangular or hastate, glabrous or with a few hairs; margins entire. VEINS free, forked or not, reaching the margin. SORI marginal or nearly so, circular or oblong, separate or confluent. INDUSIA absent but with an indusium-like reflexed margin of the pinnule. SPORES tetrahedral.

Pellaea glabella Mettenius Plate 44

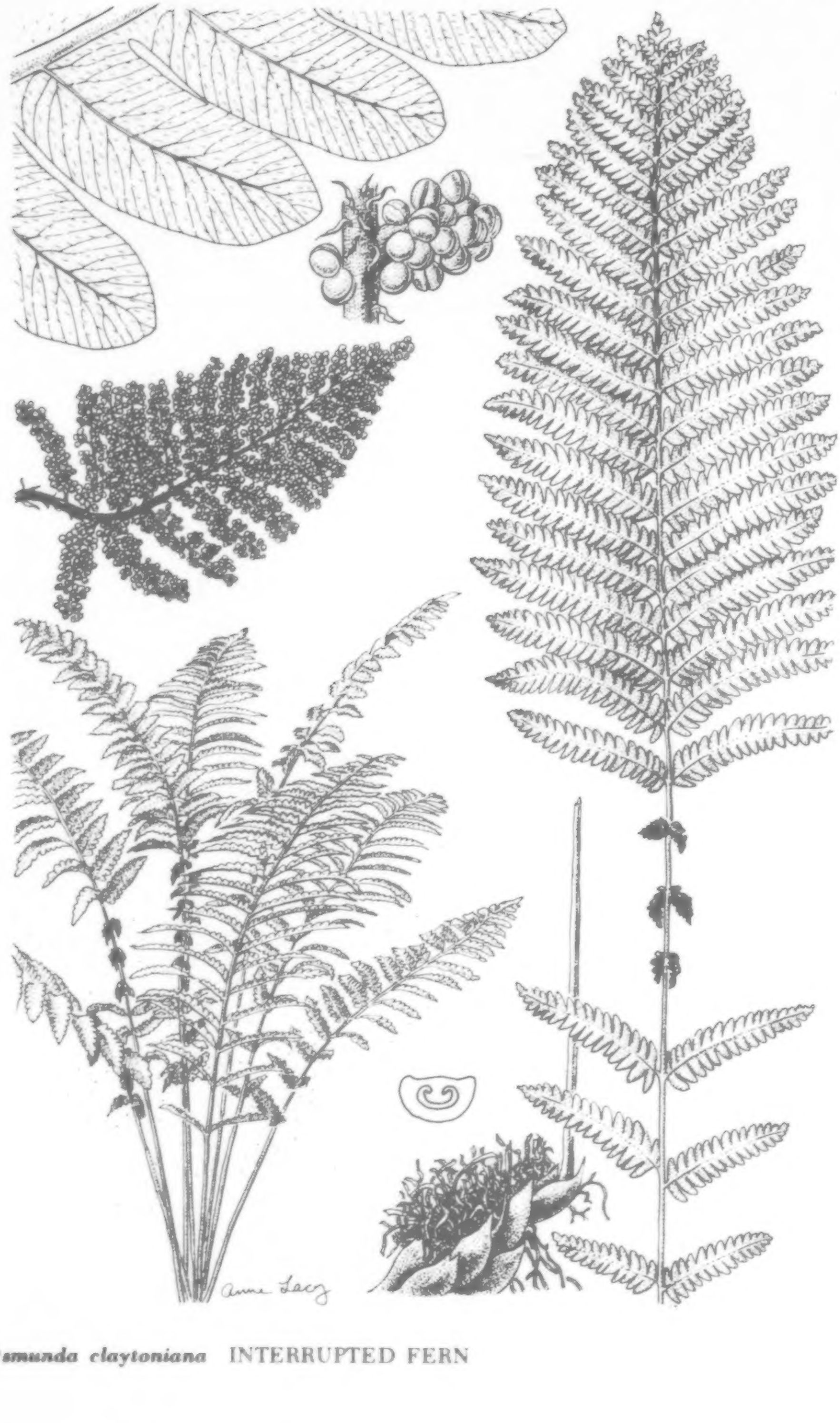
SMOOTH CLIFF BRAKE

P. atropurpurea var. *g.*

NY, Vt (rare), NJ, Pa.

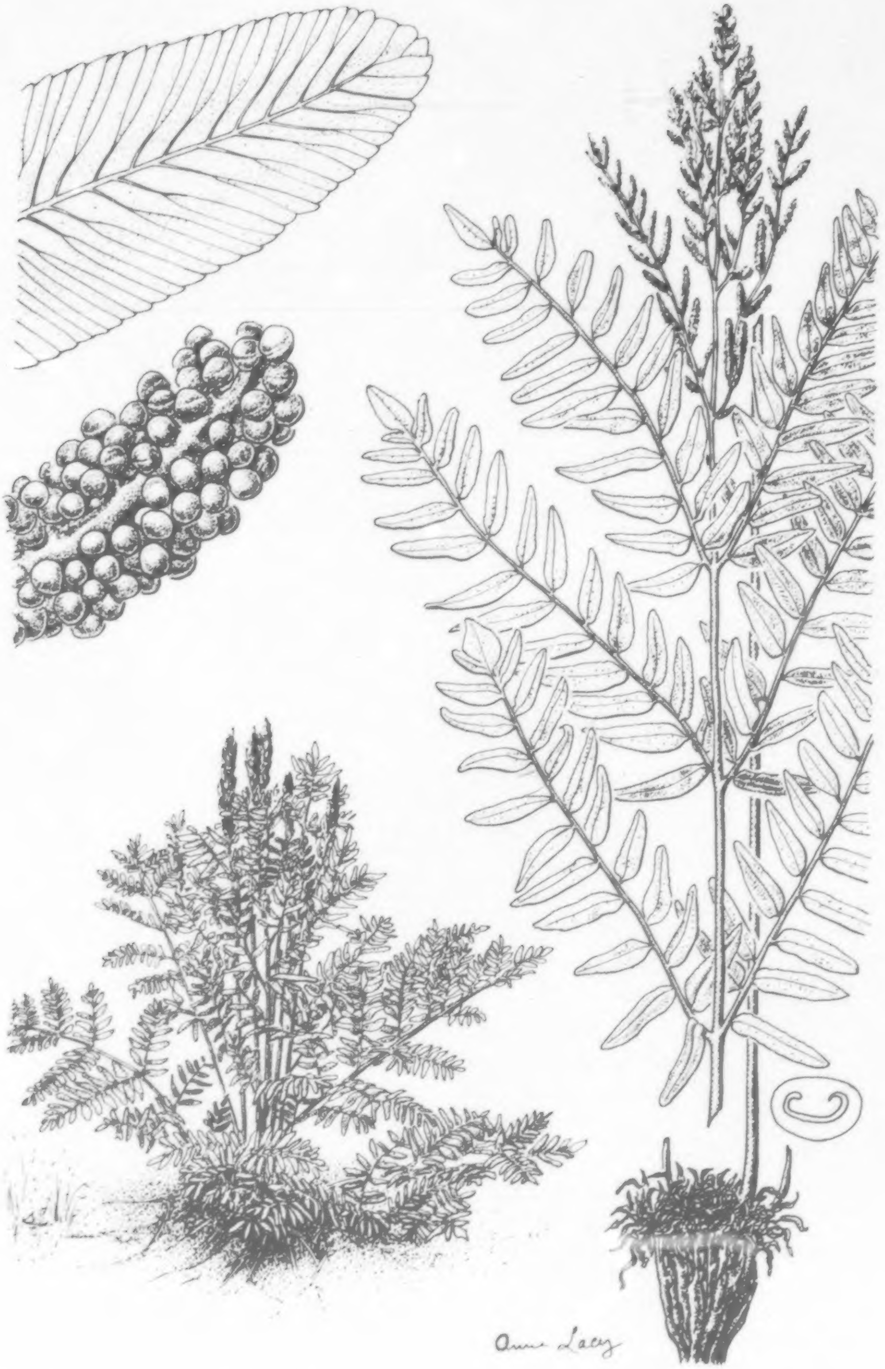
Shaded ledges and damp talus slopes, mostly on limestone, but also on shale and sandstone. Soil mostly neutral.

RHIZOMES short, branched, scaly. FRONDS not strongly dimorphic, clustered, 5-30 cm long, evergreen. STIPE dark reddish brown, shiny, usually about 1/2 to 2/3 as long as blade, mostly 5-20 cm long, wiry, glabrous or with a few spreading hairs, with a few long narrow scales, with 1 linear curved bundle. BLADES leathery, bluish green, narrowly oblong or narrowly ovate, 6-12 cm long, 2-5(-8) cm wide, pinnate



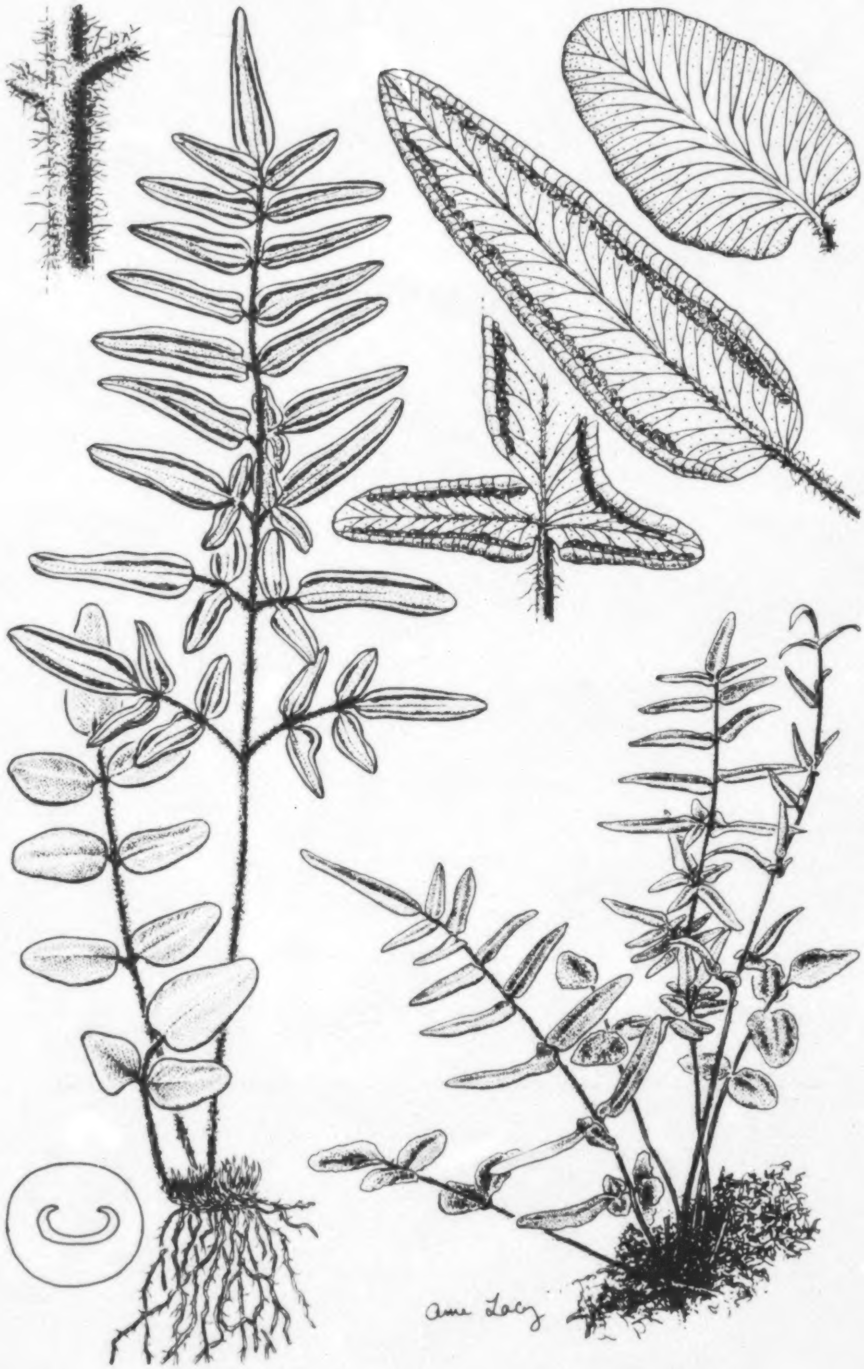
Osmunda claytoniana INTERRUPTED FERN

Plate 42



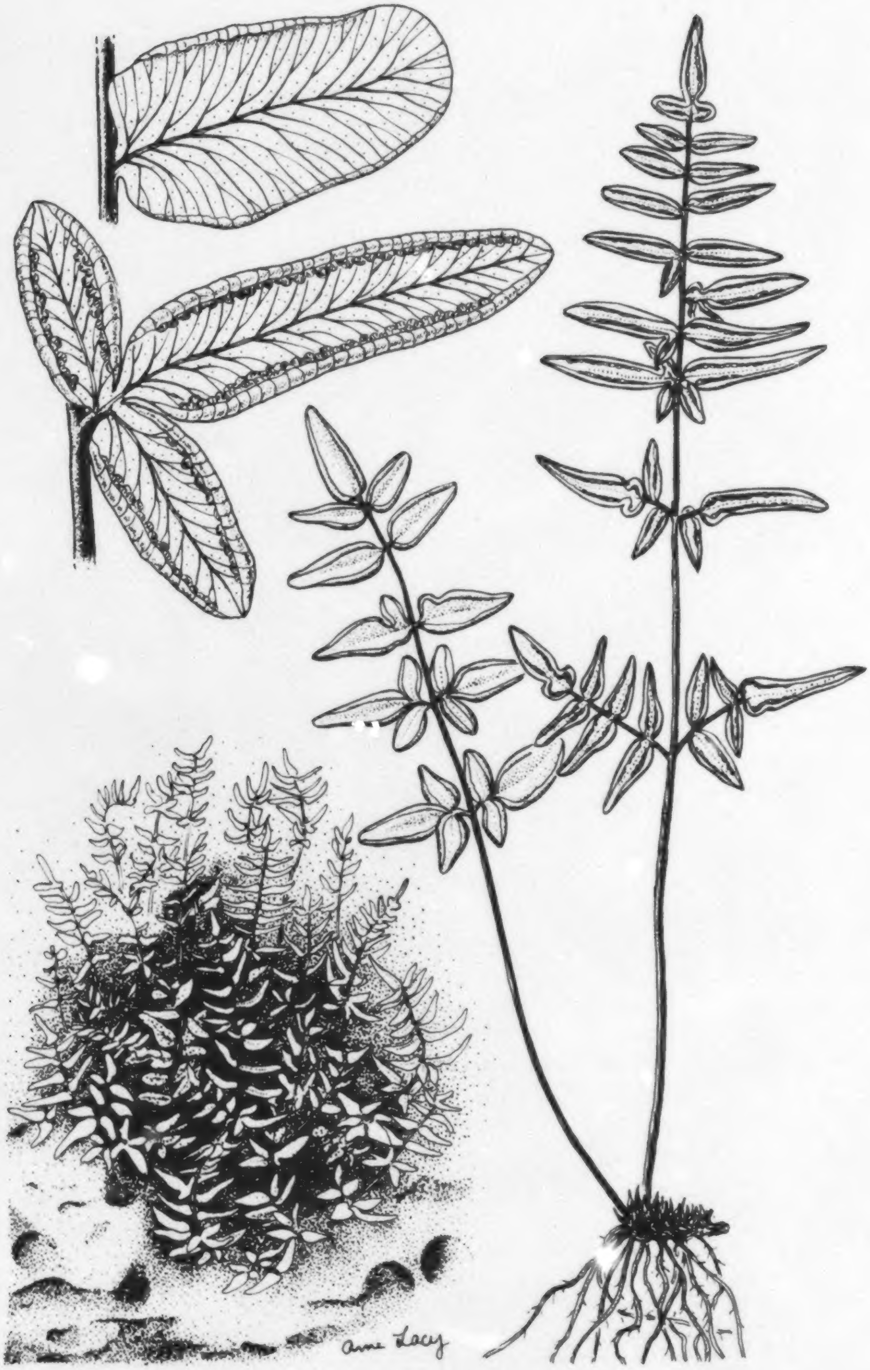
Osmunda regalis ROYAL FERN

Plate 43



Pellaea atropurpurea PURPLE CLIFF BRAKE

Plate 44



Pellaea glabella SMOOTH CLIFF BRAKE

above, bipinnate below; rachis glabrous or nearly so, shiny brown. PINNAE 5-10 pairs, opposite or nearly so, lowest pair about as long as the pair above and with 1-3(-5) pinnules. PINNULES mostly ovate, glabrous; margins entire. VEINS free, forked or not, reaching the margin. SORI marginal or nearly so, circular or oblong, separate or confluent. INDUSIA absent but with an indusium-like reflexed margin of the pinnule. SPORES tetrahedral.

Similar to *P. atropurpurea* and by some authors treated as a variety of that species.

Phegopteris connectilis (Michaux) Watt Plate 45

LONG BEECH FERN, NORTHERN BEECH FERN

P. polypodioides, Dryopteris phegopteris, Thelypteris phegopteris

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Moist rocky woods, cliffs, below dripping ledges, under small waterfalls, etc. Soil variable but mostly acid.

RHIZOMES slender, cordlike, widely creeping, 1-3 mm in diameter, densely covered with hairs and scales when young, losing them with age. FRONDS not dimorphic, solitary or a few in clusters, 8-50(-60) cm long, not evergreen. Mature STIPE longer than the blade, with hairs and scales throughout, with 2 oval or short-linear bundles at base, these united upward to form a curved bundle. BLADES triangular, about 2/3 as wide as long, (4-)10-20(-30) cm long, (2-)10-15(-25) cm wide, pinnate-pinnatifid; rachis with a few hairs on both sides and with scales on the under side. PINNAE opposite or nearly so, all except lowest 1 or 2 pinnae pairs broadly sessile at the rachis, basal pair usually pointed downward, with many hairs and scales; margins entire, sometimes ciliate. VEINS free, not or once forked, reaching the margin. SORI submarginal or not marginal, circular, separate. INDUSIA absent. SPORES bilateral.

Phegopteris hexagonoptera (Michaux) Fée Plate 46

BROAD BEECH FERN, SOUTHERN BEECH FERN

Dryopteris hexagonoptera, Thelypteris h.

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Moist or dryish, rich woods and glades. Soil acid, pH usually 5-6.

RHIZOMES slender, cordlike, creeping, 2-4 mm in diameter, densely scaly and with a few hairs. FRONDS not dimorphic, solitary at 5-15 mm intervals, 30-60(-90) cm long, not evergreen. Mature STIPE longer than the blade, glabrous or with a few hairs and scales, with 2 oval or short-linear bundles at base, these united upward to form a curved bundle. BLADES broadly triangular, mostly as wide or wider than long, 10-40 cm long, 15-40 cm wide, pinnate-pinnatifid above to bipinnate-pinnatifid below; rachis with a few whitish or pale brown hairs. PINNAE opposite or nearly so, the pairs joined at the winged rachis, basal pair usually pointed downward, with a few hairs and scales; margins entire, sometimes ciliate. VEINS free, unbranched to several times forked, reaching the margin. SORI submarginal or not marginal, circular, separate. INDUSIA absent. SPORES bilateral.

Phyllitis scolopendrium (Linnaeus) Newman Plate 47

HART'S-TONGUE

NY (rare).

Shaded, limestone cliffs and depressions. Soil neutral or nearly so.

RHIZOMES erect, scaly. FRONDS not dimorphic, clustered, 10-40 cm long, evergreen. STIPE shorter than blade, 4-12 cm long, 1-2 mm wide, with scales when young, with 2 linear, curved bundles at base, these united upward form an X-shaped bundle. BLADES broad-linear, often cordate-auriculate at base, 15-35 cm long, 2-5 cm wide, not dissected, with a few scales on the undersides, especially along their midveins; margins entire. VEINS pinnate, free, forked. SORI not marginal, linear, oblique to the midvein, 3-20 mm long, separate. INDUSIA laterally attached. SPORES bilateral.

Polypodium virginianum Linnaeus Plate 48

COMMON POLYPODY, ROCK POLYPODY

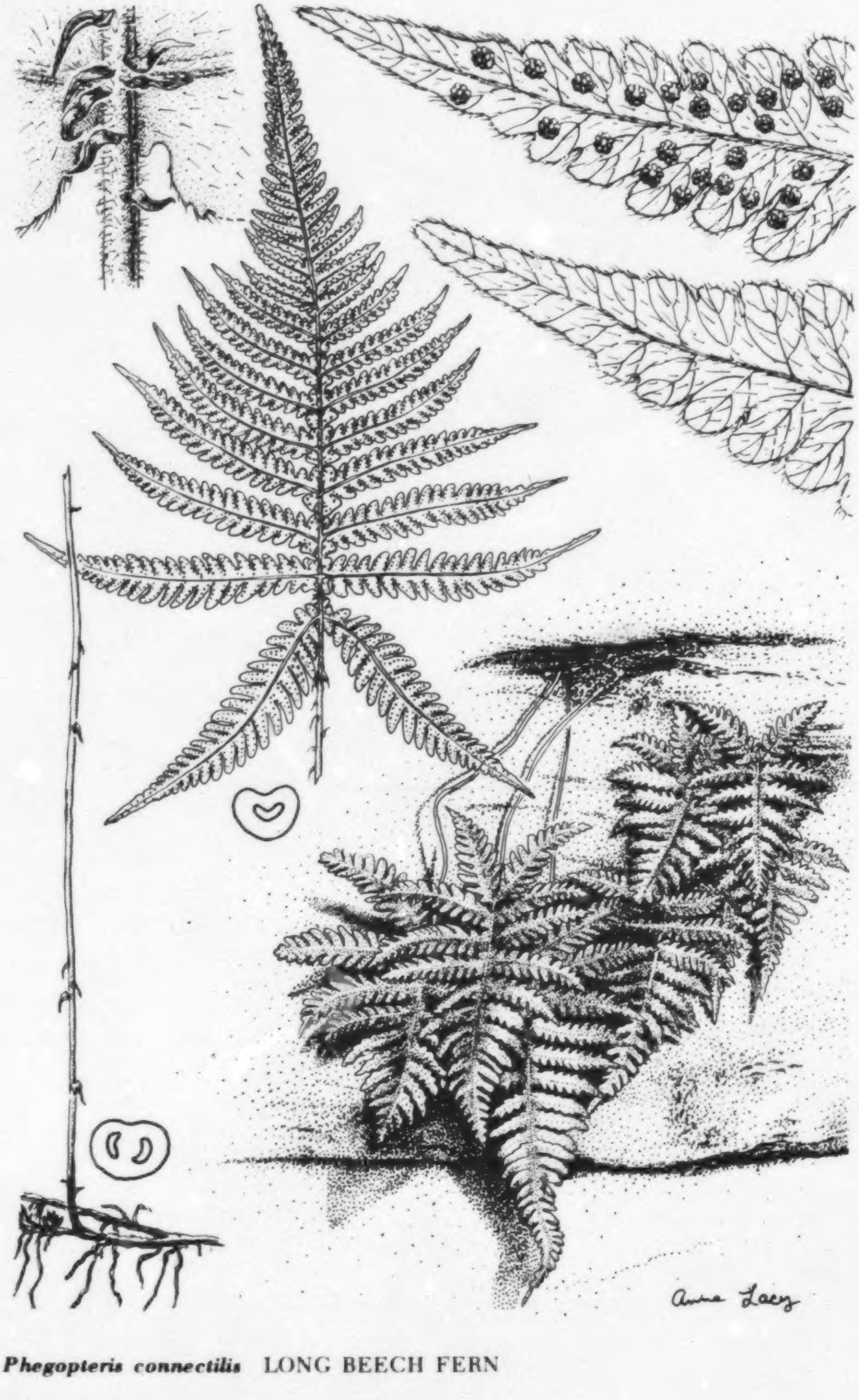
P. vulgare

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Thin soil (shallow leaf mold) on large rocks and cliffs, rocky banks, sometimes on fallen logs or tree bases, in open woods or swamps. Soil variable, acid to alkaline.

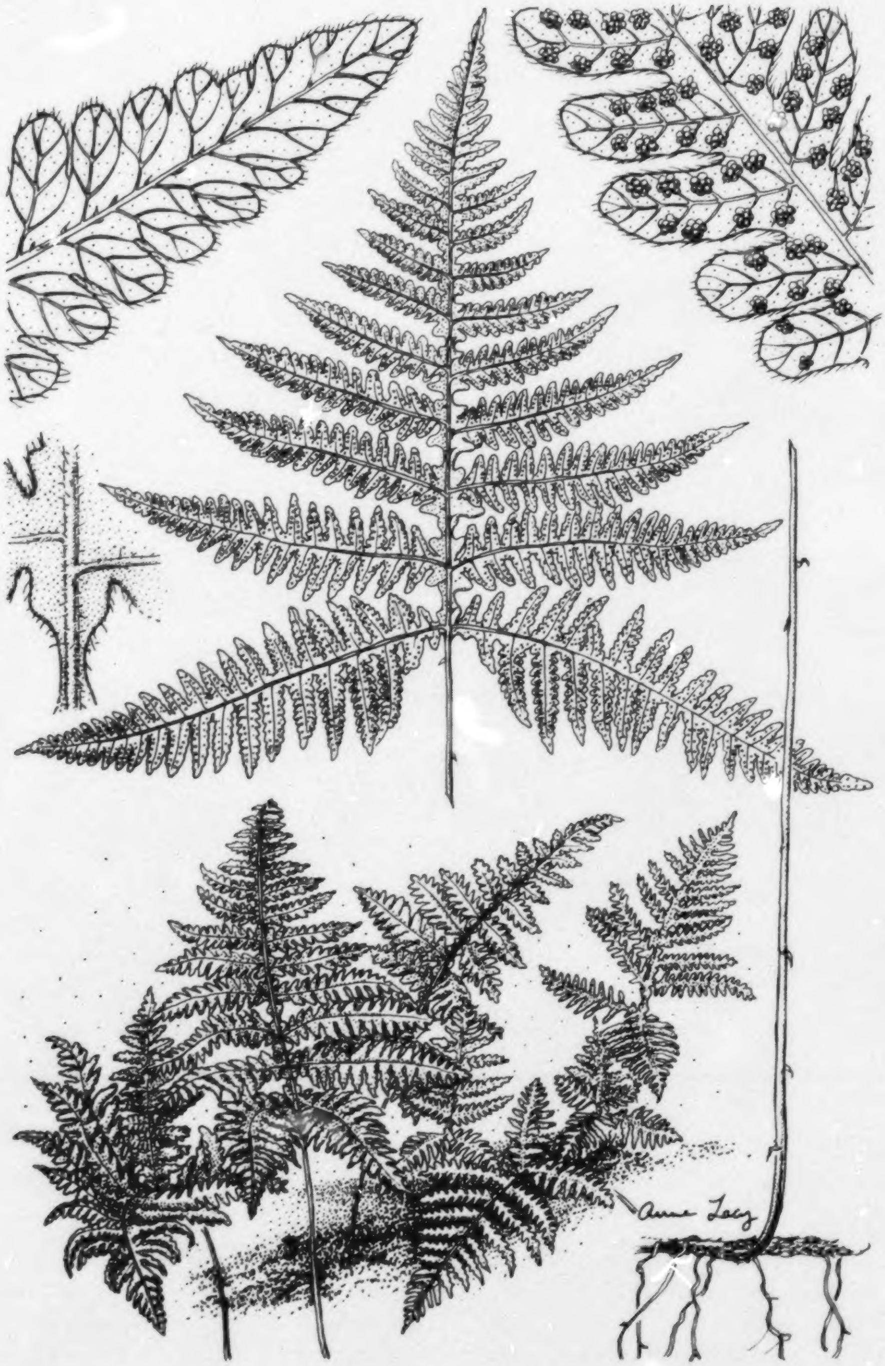
RHIZOMES ropelike, spongy, branched, often partly exposed and matlike, 2-7 mm in diameter, densely covered with brown scales. FRONDS not dimorphic, rising separately from points on the rhizome, mostly 10-30 cm long, evergreen and persistent after new fronds appear. STIPE usually about 2/3 as long as blade, glabrous, scurfy, with scales only at base, with 3 circular bundles at extreme base, these united near the base to 2 and then to 1 toward the blade. BLADES oblong-lanceolate, 5-20(-25) cm long, 2-6 cm wide, pinnatifid or pinnate (rarely pinnate-pinnatifid), rachis winged, without scales, or rarely with a few.

Plate 45



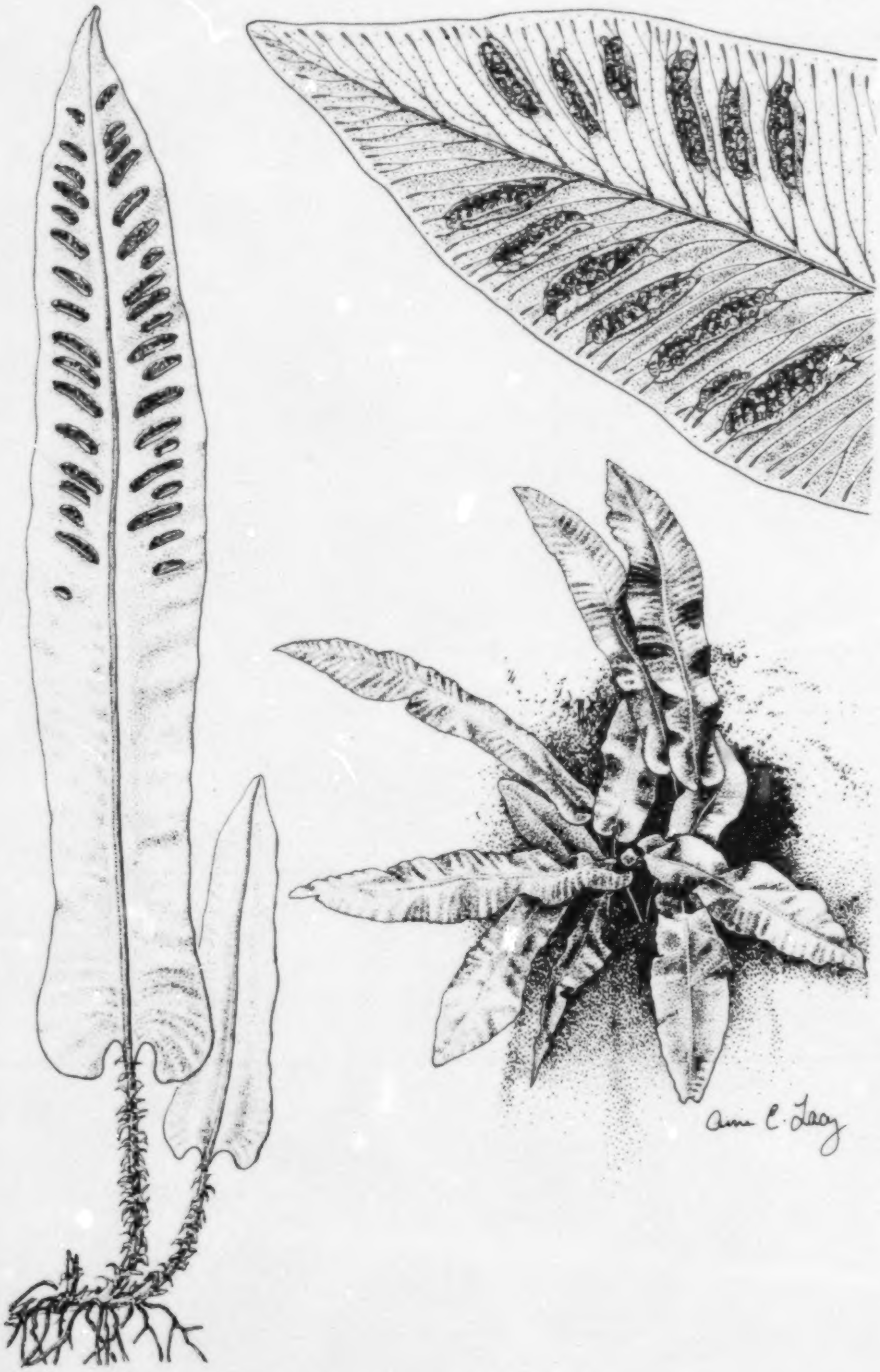
Phegopteris connectilis LONG BEECH FERN

Plate 46



Phegopteris hexagonoptera BROAD BEECH FERN

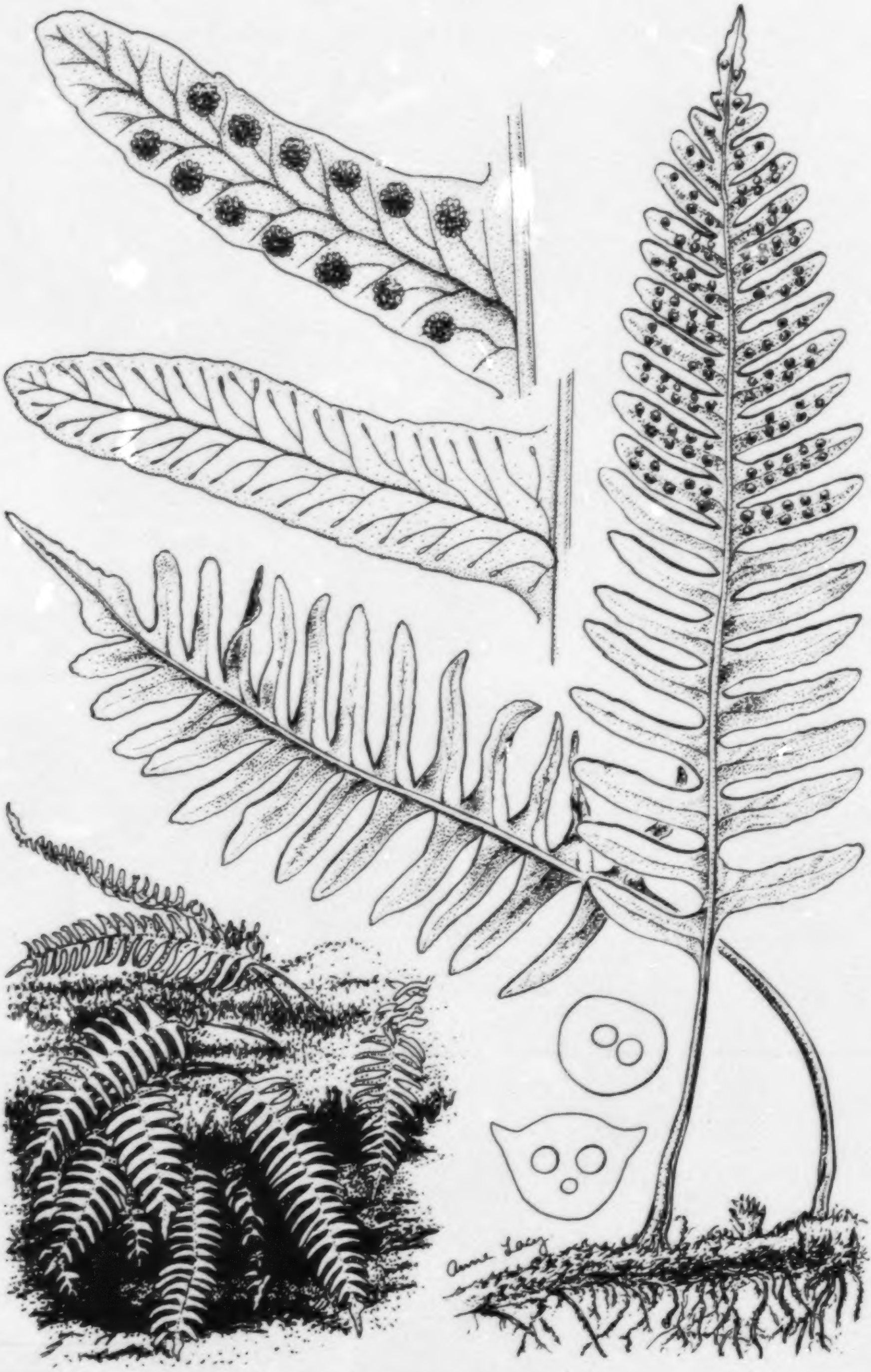
Plate 47



Ann C. Lacy

Phyllitis scolopendrium HART'S-TONGUE

Plate 48



Polypodium virginianum COMMON POLYPODY

PINNAE (segments) mostly alternate, 10-20 pairs, linear-oblong, glabrous; margins entire or slightly undulate-dentate with shallow teeth. VEINS free, forked, enlarged at apex, not reaching the margin. SORI not marginal, but they may appear marginal because of their large size, usually separate. INDUSIA absent. SPORES bilateral.

Polystichum acrostichoides (Michaux) Schott
Plate 49

CHRISTMAS FERN

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Moist shady areas in rocky woods. Can tolerate sun if soil is moist. Soil acid to neutral, pH usually 5-7.

RHIZOMES stout, short, creeping and ascending, 6-10 mm in diameter, scaly and with old stipe bases and wilted fronds. CROZIERS about 1 cm in diameter, with long silvery-white scales. FRONDS somewhat dimorphic in that those with fertile pinnae are longer than the completely sterile fronds and the fertile pinnae are smaller and only at the upper part of the blade, clustered, (10-)30-75(-150) cm long, evergreen. STIPE ¼ to ½ as long as the blade, brown at base, green above, densely covered with persistent scales, with 4 or 5 circular bundles at base and upward. BLADES dark green, usually lanceolate, (15-)20-50(-70) cm long, 4-13 cm wide, pinnate (typical form); rachis green, scaly. PINNAE leathery, opposite at base, alternate above, (10-)20-35 pairs, linear-oblong, acute at apex, each base with an auricle on the upper side, lowest pair about the same length, or slightly shorter than middle pinnae, glabrous on the upper side, with scales (some hairlike) on the underside; margins with small or large bristle-tipped teeth. VEINS free, forked, reaching the margin. SORI not marginal, in two rows along the midvein, circular, separate but crowded, confluent at maturity. INDUSIA circular, with a wavy margin, peltate, shrivel and disappear with age. SPORES bilateral.

Many variations in pinna shape and dissection may be found.

Polystichum lonchites, NORTHERN HOLLY FERN, is represented in our area by a single fragmentary collection from western New York. It has not been reported since 1940.

Polystichum braunii (Spenner) Fée Plate 50

BRAUN'S HOLLY FERN

NY, Vt, NH, Me, Mass, Pa.

Cool, moist rocky humus-rich woods and ledges. Soil neutral or nearly so.

RHIZOMES stout, short, erect, about 5 mm in diameter, scaly, and with old stipe bases. CROZIERS for the next year's fronds formed during late summer, covered with silvery white scales. FRONDS not dimorphic, clustered, 30-90(100) cm long, not or semi-evergreen. STIPE about ¼ as long as blade, yellow-green to brown, densely covered with scales and with a few hairs, with 4 or 5 circular or oval bundles at base and upward. BLADES dark green, elliptic, 25-70(-90) cm long, 7-20 cm wide, mostly bipinnate; rachis scaly and with long hairs. PINNAE leathery, nearly opposite at base, alternate above, (20-)30-40 pairs, linear-lanceolate, acute at apex, lowest pair much shorter than middle pinnae. PINNULES ovate-oblong to ovate-triangular, acute at apex, slightly auriculate at base, with scales and hairs on the midveins; margins with incurved, bristle-tipped teeth. VEINS free, forked, reaching the margin, with linear scales. SORI on the vein forks, not marginal, circular, separate. INDUSIA circular, peltate, with wavy margins. SPORES bilateral.

Pteridium aquilinum (Linnaeus) Kuhn Plate 51

BRACKEN, BRAKE FERN

P. latiusculum

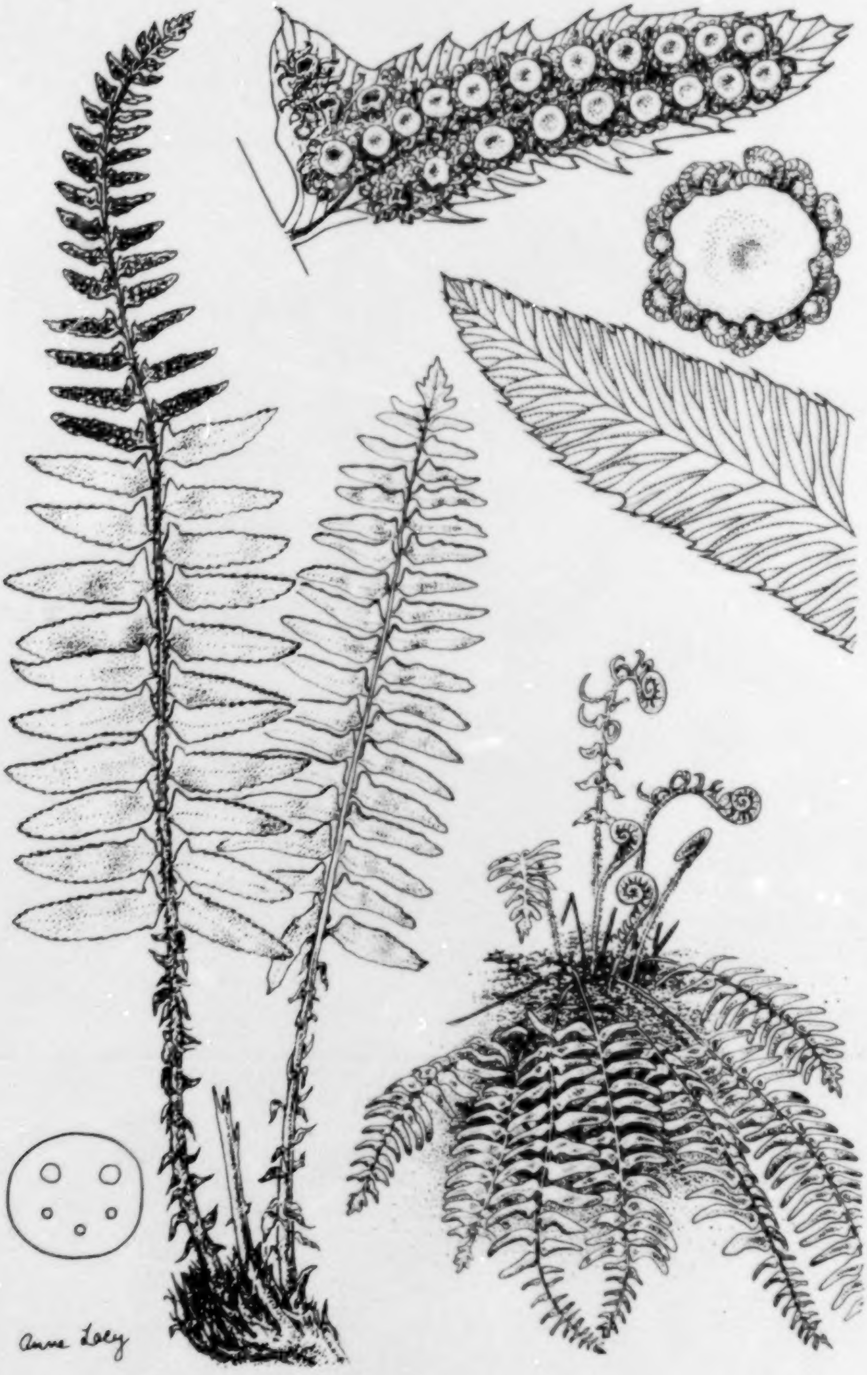
NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Dry, sandy or sterile soil of fields, sometimes invading open woods. Soil acid to neutral.

RHIZOMES cordlike, branched, blackish, 5-15 mm in diameter, without scales, often with a few hairs at the growing tip. CROZIERS in groups of three, covered with silvery-gray hairs. FRONDS not dimorphic, scattered on the rhizome, 20-100(-150) cm long, not evergreen. STIPE woody, variable in length, dark purple-brown at base, straw-colored above, glabrous, or with a few hairs at base, with several (often more than 10) bundles of various sizes, shapes, and arrangements, some of which unite upward. BLADES broad-triangular to ovate, (12-)20-50(-100) cm long, (15-)35-75 cm wide, often ternate, bipinnate-pinnatifid to tripinnate-pinnatifid; rachis glabrous or nearly so. PINNAE opposite, the basal pair much larger than the others. PINNULES oblong-linear, glabrous or with a few hairs on midveins and margins; margins curled inward, entire. VEINS free, forked, reaching the margin. SORI marginal, linear, nearly continuous (a fungus that appears on the underside of the pinnules must not be mistaken for sori). INDUSIA the reflexed margin of the pinnule, silvery-white, delicate. SPORES tetrahedral.

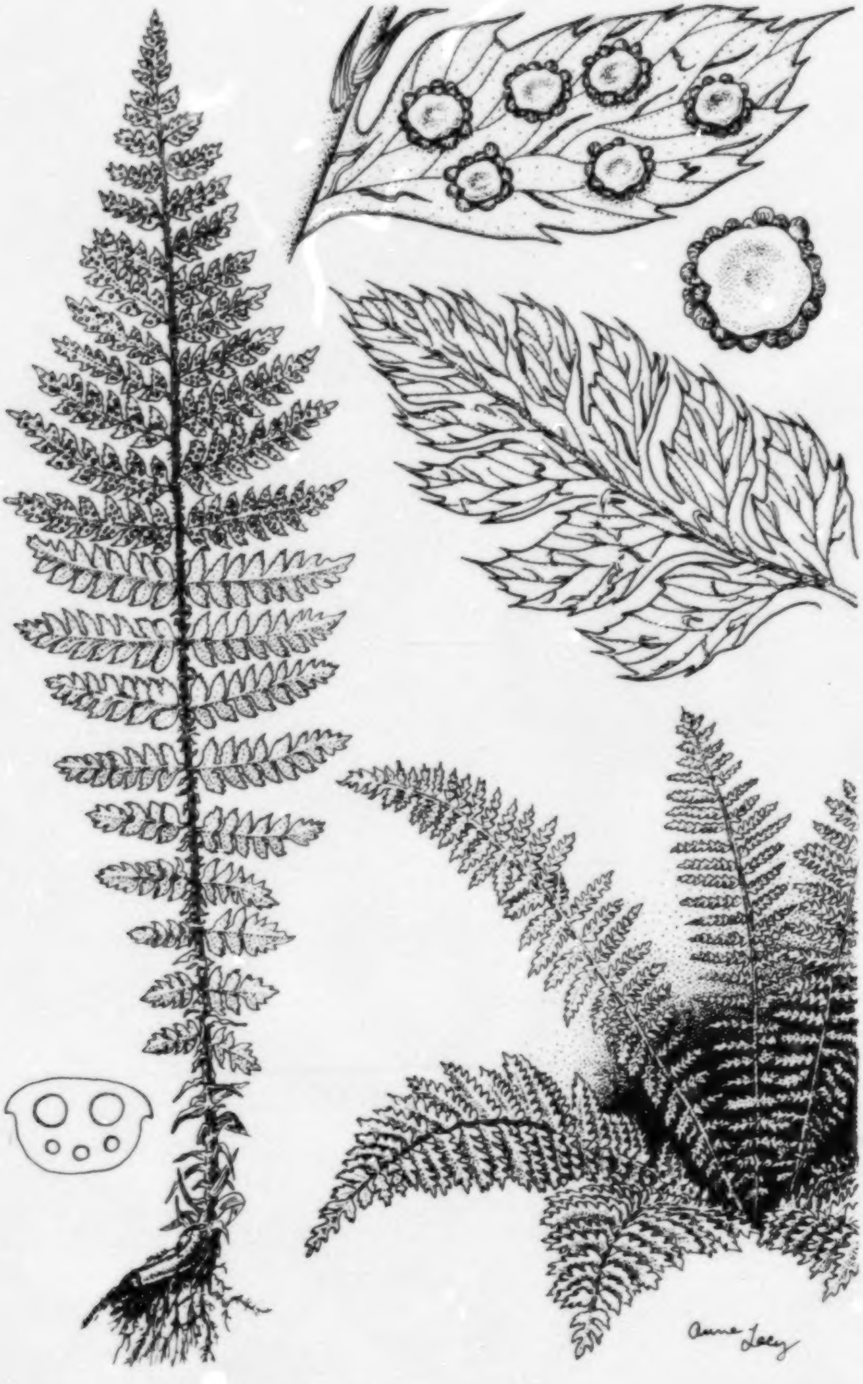
Very common and weedy.

Plate 49



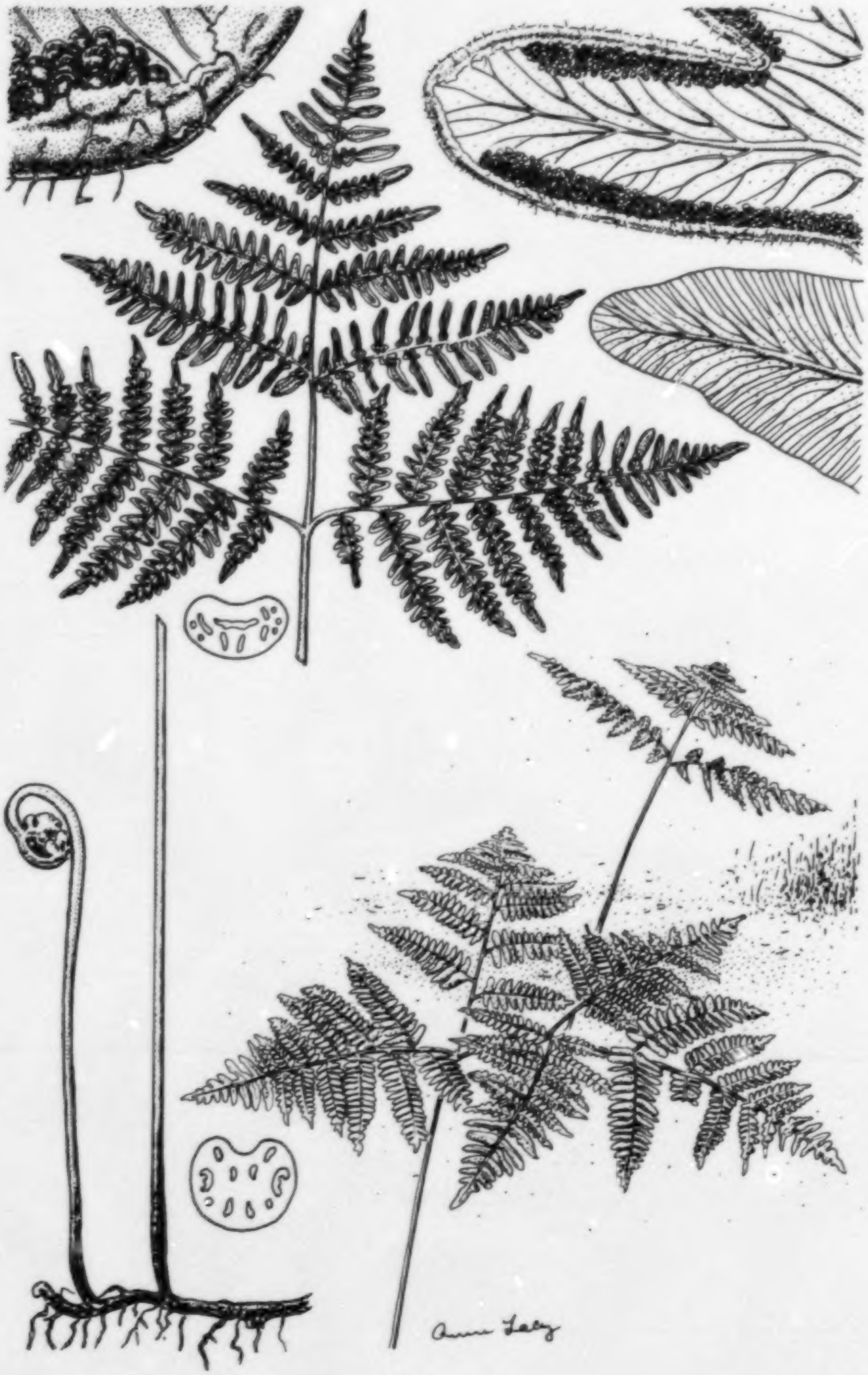
Polystichum acrostichoides CHRISTMAS FERN

Plate 50



Polystichum braunii BRAUN'S HOLLY FERN

Plate 51



Pteridium aquilinum BRACKEN

Schizaea pusilla Pursh Plate 52

CURLY GRASS

NY (rare), NJ.

Bogs, wet grassy depressions, hummocks of mossy humus in sandy areas. Soil very acid.

RHIZOMES short, erect. FRONDS not fernlike, dimorphic, clustered, STERILE FRONDS linear, filiform, 1-6 cm long, 1 mm wide or less, with no distinction between stipe and blade, curled, glabrous. FERTILE FRONDS 2-12 cm long, stipe much longer than blade. FERTILE BLADES 2-4 mm long, pinnate, comblike, with about 4-7 pairs of pinnae. PINNAE 1.5-4 mm long. SPORANGIA 8-14 per pinna. SPORES oval, 85-100 microns in longest diameter, surface granular-pitted.

Thelypteris noveboracensis (Linnaeus) Nieuwland Plate 53

NEW YORK FERN

Dryopteris n.

NY, VT, NH, Me, Mass, Ct, RI, NJ, Pa.

Moist or dryish, shady, rich woods or glades and edges of swamps. Soil moderately acid.

RHIZOMES slender, cordlike, branching, 1.5-2.5 mm in diameter, scales few or absent. FRONDS not dimorphic, solitary and scattered or 3 or 4 in a cluster, 25-70(-90) cm long, not evergreen. STIPE much shorter than blade, glabrous or with a few hairs, scaly at base, with 2 oval or short-linear bundles at base, these united upward to form a curved bundle. BLADES elliptic, 20-50 cm long, 8-15 cm wide, pinnate-pinnatifid to nearly bipinnate; rachis glabrous or with a few hairs on the underside, without scales. PINNAE linear-lanceolate, sessile, lowest very short. PINNULES (segments) linear-oblong, with a few hairs on the veins; margins entire or nearly so, ciliate. VEINS free, not forked on sterile segments, rarely forked on fertile segments, reaching the margin. SORI not marginal but usually nearer the margin than the midvein, circular, separate or rarely confluent. INDUSIA reniform, often circular but with a sinus, persistent but may shrink with age, ciliate. SPORES bilateral.

Thelypteris palustris Schott Plate 54

MARSH FERN

T. thelypteris, T. thelypterioides, Dryopteris thelypteris

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Marshes, swamps, bog margins, wet woods, low meadows. Soil usually slightly acid.

RHIZOMES slender, creeping, 1-2 mm in diameter, with very few scales. FRONDS slightly dimorphic, in that fertile fronds usually have longer stipes and the pinna segments are narrrower with partially inrolled margins, borne singly and scattered on the rhizome, (10-)20-80(-120) cm long, not evergreen. STIPE shorter or longer than the blade, glabrous or nearly so, with a few scales when young, with 2 circular or oval bundles at base, these united upward. BLADES oblong-lanceolate, 10-40 cm long, 8-20 cm wide, pinnate-pinnatifid to bipinnate; rachis with tiny hairs. PINNAE linear-lanceolate, sessile or with a short stalk, lowest pair about same length or slightly shorter than middle pinnae. PINNULES (segments) with some tiny hairs on the midveins, at least when young, sometimes with a few scales on the midveins; margins entire or shallowly dentate. VEINS free, forked (at least on sterile segments), reaching the margin. SORI not marginal, circular, near the midvein, enclosed by the inrolled pinna margin when young, separate but crowded, confluent with age. INDUSIA reniform, often circular, but with a sinus, fragile, usually slightly ciliate, shriveling or disappearing with age. SPORES bilateral.

Thelypteris simulata (Davenport) Nieuwland Plate 55

MASSACHUSETTS FERN, BOG FERN

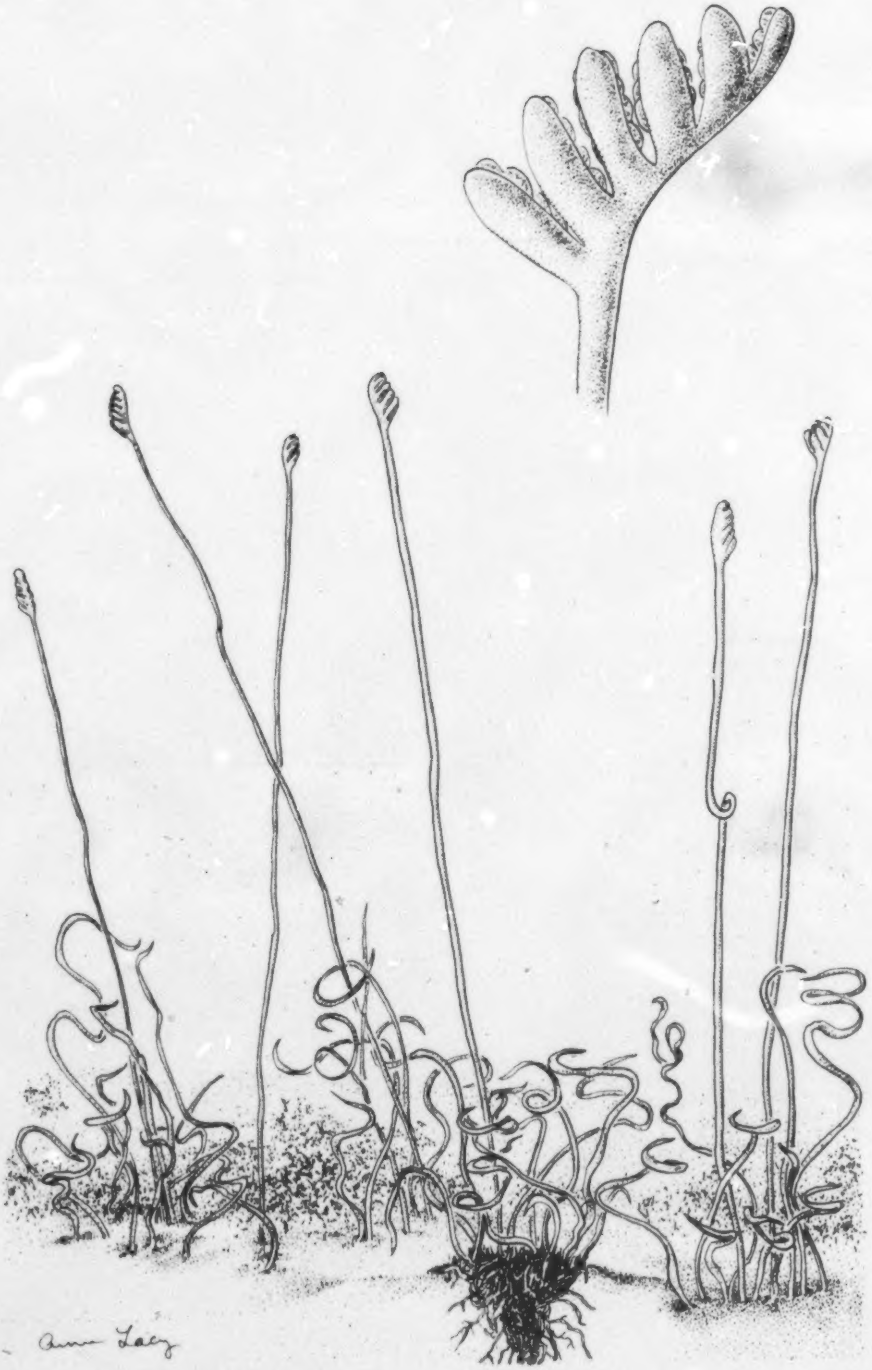
Dryopteris simulata

NY, Vt, NH, Me, Mass, Ct, RI, NJ, Pa.

Swamps, shaded bog margins, moist woods. Soil very acid.

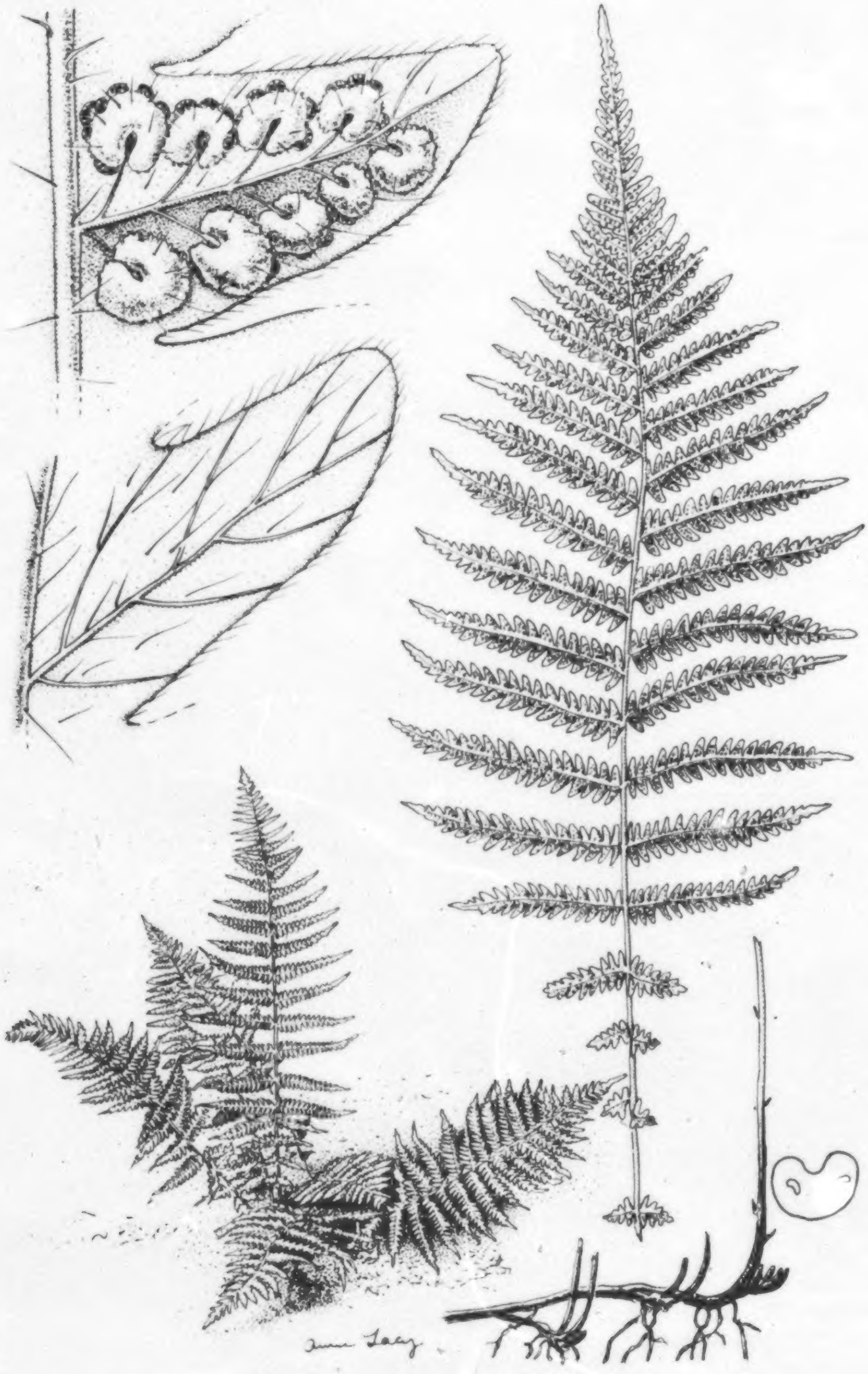
RHIZOMES creeping, branching, 2-3(-4) mm in diameter, glabrous, with a few scales. FRONDS not dimorphic (although fertile fronds are usually longer than sterile fronds), solitary, 35-55 cm long, not evergreen. STIPE about same length as blade, glabrous, without scales or a few at base, with 2 oval or short-linear bundles at base, these united upward to form a curved bundle. BLADES lanceolate, 18-35(-50) cm long, 8-15 cm wide, pinnate-pinnatifid to nearly bipinnate; rachis glabrous on the upper side, with a few hairs on the underside, without scales. PINNAE lanceolate, sessile, lowest pair about same length or a little shorter than middle pinnae. PINNULES (segments) oblong, mostly glabrous but with a few hairs on the veins; margins entire. VEINS free, not forked, reaching the margin. SORI not marginal but often nearer the margin than the midvein, circular, separate. INDUSIA reniform, often circular but with a sinus, persistent, with tiny glands on the margins. SPORES bilateral.

Plate 52



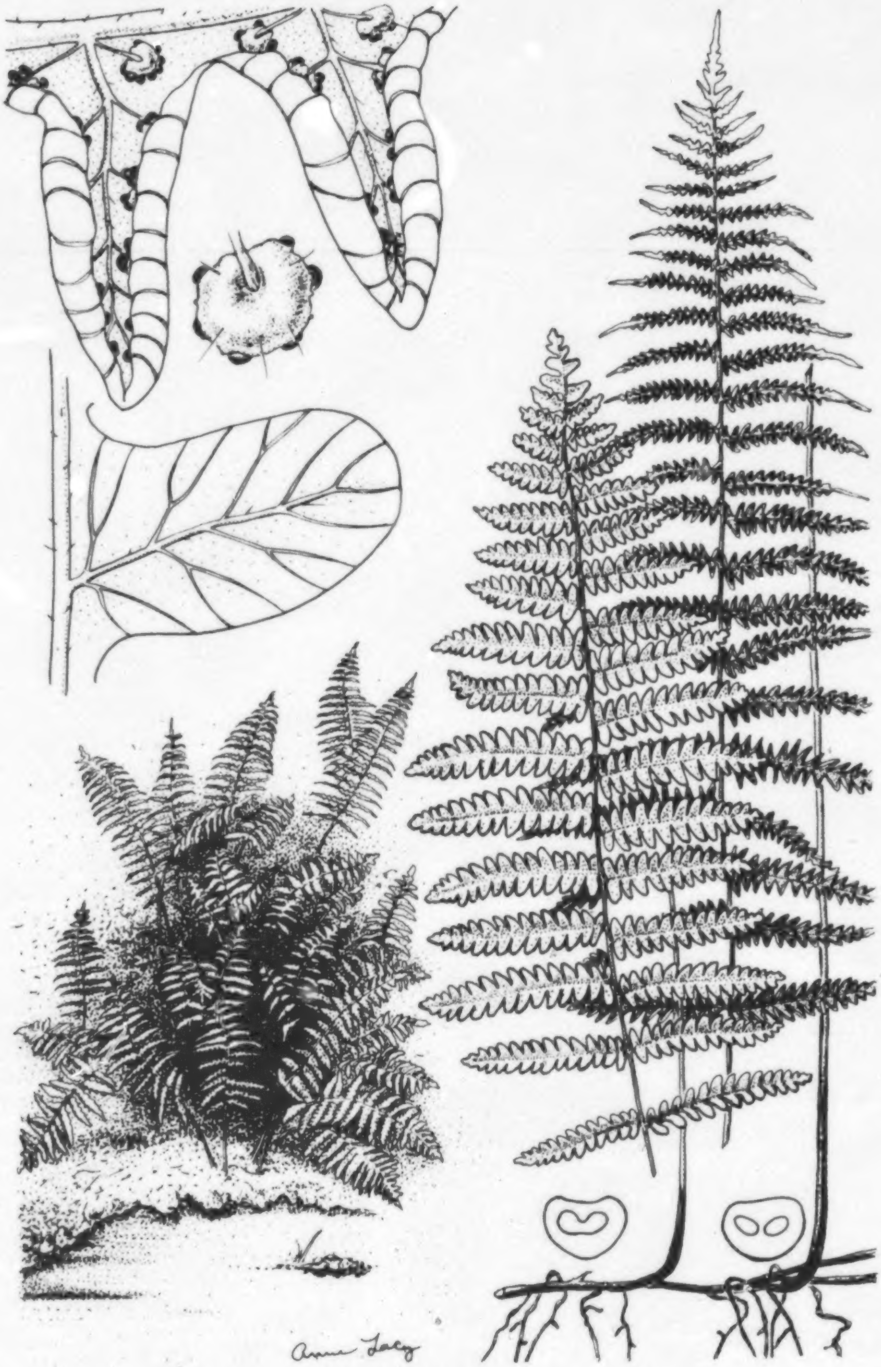
Schizaea pusilla CURLY GRASS

Plate 53



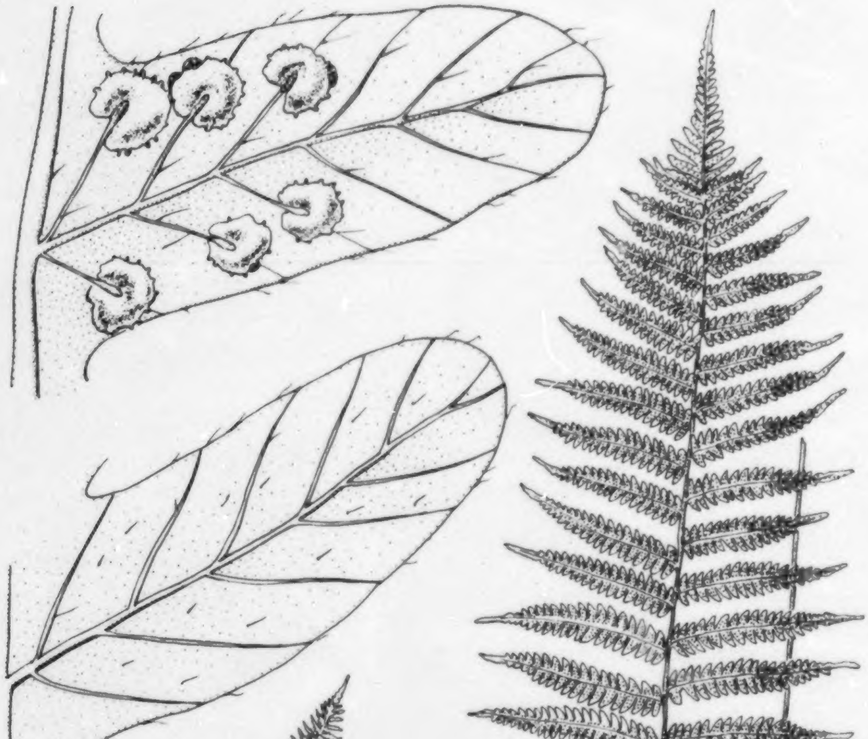
Thelypteris noveboracensis NEW YORK FERN

Plate 54



Thelypteris palustris MARSH FERN

Plate 55



Thelypteris simulata MASSACHUSETTS FERN

Woodsia alpina (Bolton) S. F. Gray Plate 56

ALPINE WOODSIA

NY (rare), Vt (rare), Me (rare).

Crevices in shaded rock at high elevations. Soil calcareous or neutral to slightly acid.

RHIZOMES slender, short, with a few scales and with old stipe bases of nearly equal length. FRONDS not dimorphic, in dense clusters, 6-15(-22) cm long, not evergreen. STIPE shorter than the blade, jointed below the middle, nearly black at base, brown to yellowish or greenish above, shiny, with a few hairs and scales, with 2 circular or oval bundles at base, these united very near the base forming a V-shaped bundle. BLADES linear-lanceolate, (2-)8-15 cm long, (0.5-)1-2.5 cm wide, pinnate-pinnatifid; rachis glabrous or with a few hairs and a few scales. PINNAE 5-18 pairs, ovate, sessile, lowest pair usually shorter than middle pinnae, glabrous on the upper sides, with a few hairs on the undersides, scales few or none; margins entire. VEINS free, forked, mostly not reaching the margin. SORI near the pinna margin, circular, separate or confluent. INDUSIA cuplike when young, soon raylike, being small disks with long, septate hairlike segments. SPORES bilateral.

Woodsia glabella R. Brown Plate 57

SMOOTH WOODSIA

NY (rare), Vt (rare), NH (rare), Me (rare).

Wet, shaded ledges of calcareous rock, mostly at high elevations. Soil neutral or nearly so.

RHIZOMES slender, short, with scales and with old stipe bases of nearly equal length. FRONDS not dimorphic, in small clusters, 5-16 cm long, not evergreen. STIPE shorter than the blade, jointed below the middle, greenish or straw-colored, glabrous, with scales at base only, with 2 circular or oval bundles at base, these united near the base, forming a V-shaped bundle. BLADES linear or linear-lanceolate, 4-8 cm long, 0.6-1.5 cm wide, pinnate-pinnatifid; rachis without hairs or scales. PINNAE 6-23 pairs, nearly circular to triangular, often 3-lobed, sessile, shorter than middle pinnae, glabrous; margins entire or crenate. VEINS free, forked, mostly not reaching the margin. SORI near the margin, circular, separate or confluent with age. INDUSIA cuplike when young, soon raylike, being small disks with septate, hairlike segments. SPORES bilateral.

Woodsia ilvensis (Linnaeus) R. Brown Plate 58

RUSTY WOODSIA, RUSTY CLIFF FERN

NY, Vt, NH, Me, Mass, Ct, RI (rare), NJ, Pa.

Dry exposed cliffs, ledges, rocky slopes, often in full sun. Soil usually acid, pH mostly 5-6, but sometimes nearly neutral.

RHIZOMES short, often branched, with many scales and with old stipe bases of nearly equal length. CROZIERS covered with silvery-white hairs. FRONDS not dimorphic, in dense clusters, 5-25 cm long, not evergreen. STIPE shorter than blade (rarely longer), jointed at or below the middle, dark brown, shiny, with hairs and hair-tipped scales, with 2 circular or oval bundles at base, these united very near the base forming a V-shaped bundle. BLADES oblong-lanceolate, 5-12(-15) cm long, 1-4 cm wide, pinnate-pinnatifid to bipinnate; rachis hairy and scaly. PINNAE (7-)10-16(-23) pairs, ovate-lanceolate, each pinna usually with 4-7 lobes, sessile, lowest pinnae usually slightly shorter than middle pinnae, densely hairy with long rust-brown (whitish when young) hairs, densely scaly; margins shallowly crenate. VEINS free, forked, mostly not reaching the margin. SORI near the margin, usually hidden by the hairs, circular, separate but close and confluent with age. INDUSIA cuplike when young, soon raylike, being small disks surrounded by many hairlike segments. SPORES bilateral.

Woodsia obtusa (Sprengel) Torrey Plate 59

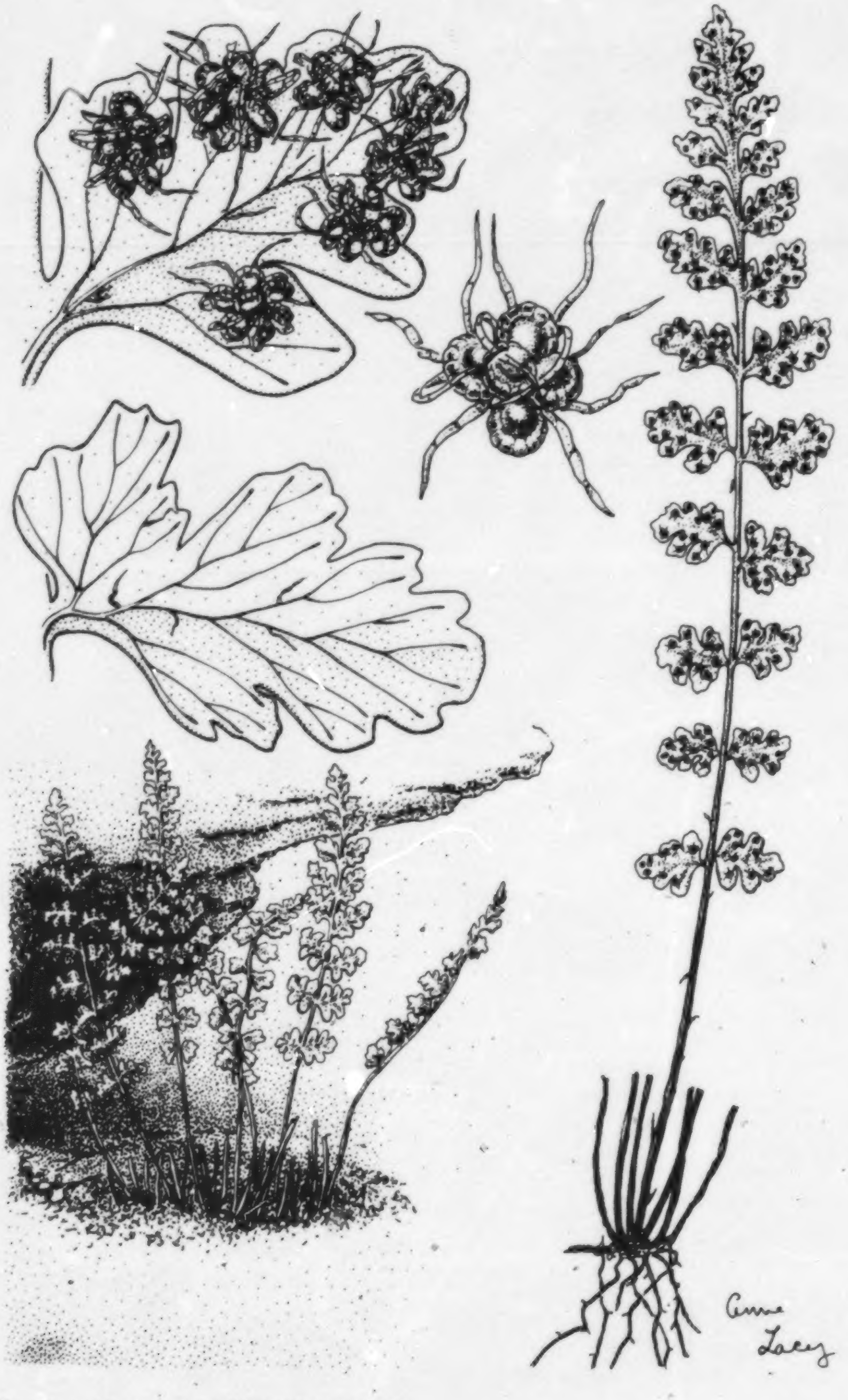
BLUNT-LOBED WOODSIA

NY, Vt, NH, Me (rare), Mass, Ct, RI, NJ, Pa.

Shaded crevices in cliffs, rocky ledges, talus slopes, on cement, sometimes open woods. Soil acid to neutral, pH usually 5-7.

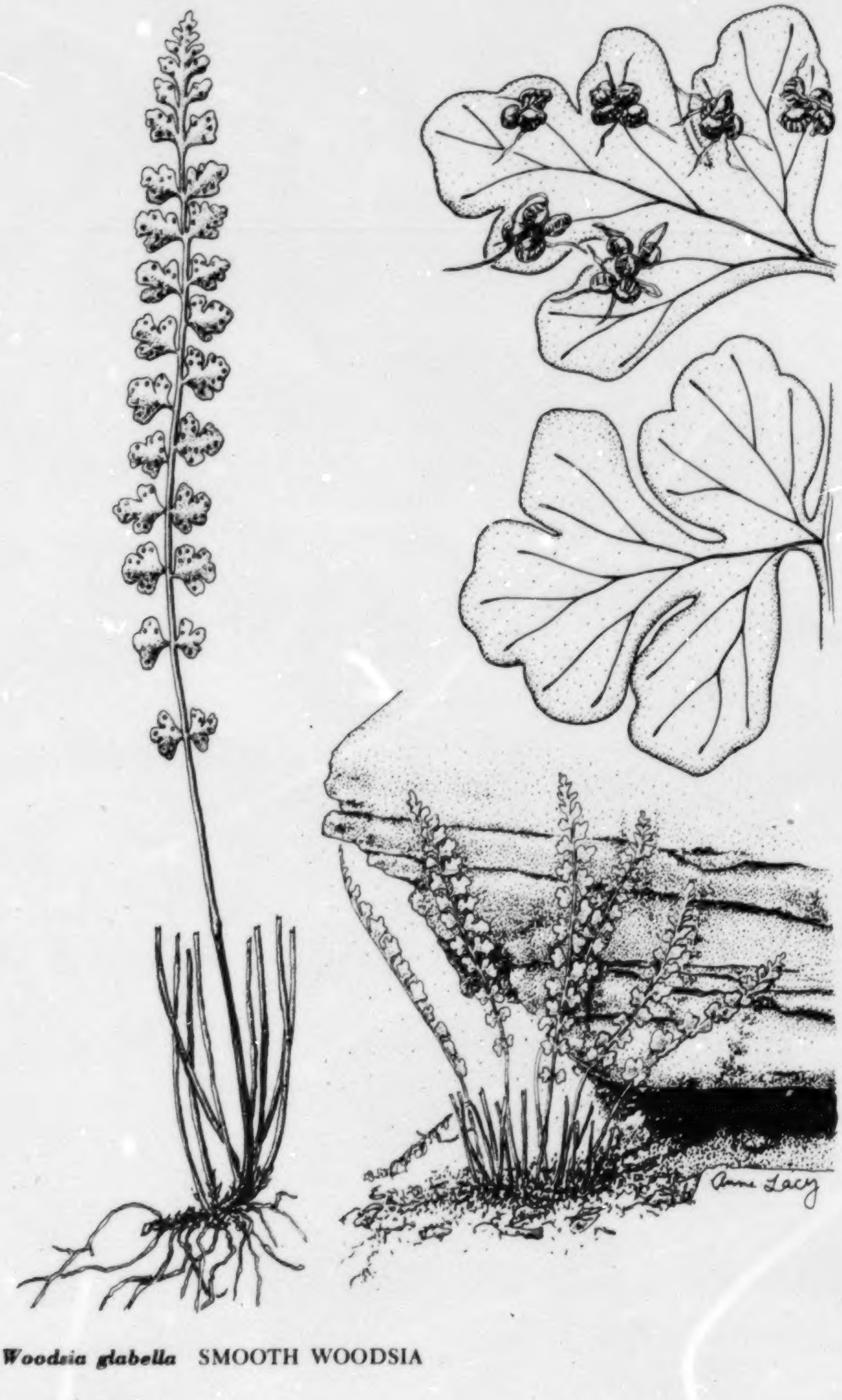
RHIZOMES stout, often branched, with a few brown scales, with stipe bases of unequal length and with persistent old fronds. FRONDS not or slightly dimorphic, in clusters, (10-)25-40(-55) cm long, semi-evergreen. STIPE shorter than the blade, not jointed, dark orange at base, straw-colored or greenish above, hairy and scaly, with 2 circular or oval bundles at base, these united very near the base forming a V-shaped bundle. BLADES lanceolate, 10-25(-40) cm long, (2-)3-10(-15) cm wide, pinnate-bipinnatifid or bipinnate-pinnatifid, greenish when young, becoming yellowish with age; rachis with glandular hairs and a few scales. PINNAE 8-20 pairs, ovate to ovate-lanceolate, sessile or nearly so, lowest pair shorter than middle pinnae. PINNULES 5-9 pairs, oblong, with obtuse lobes, with small white glandular hairs on

Plate 56



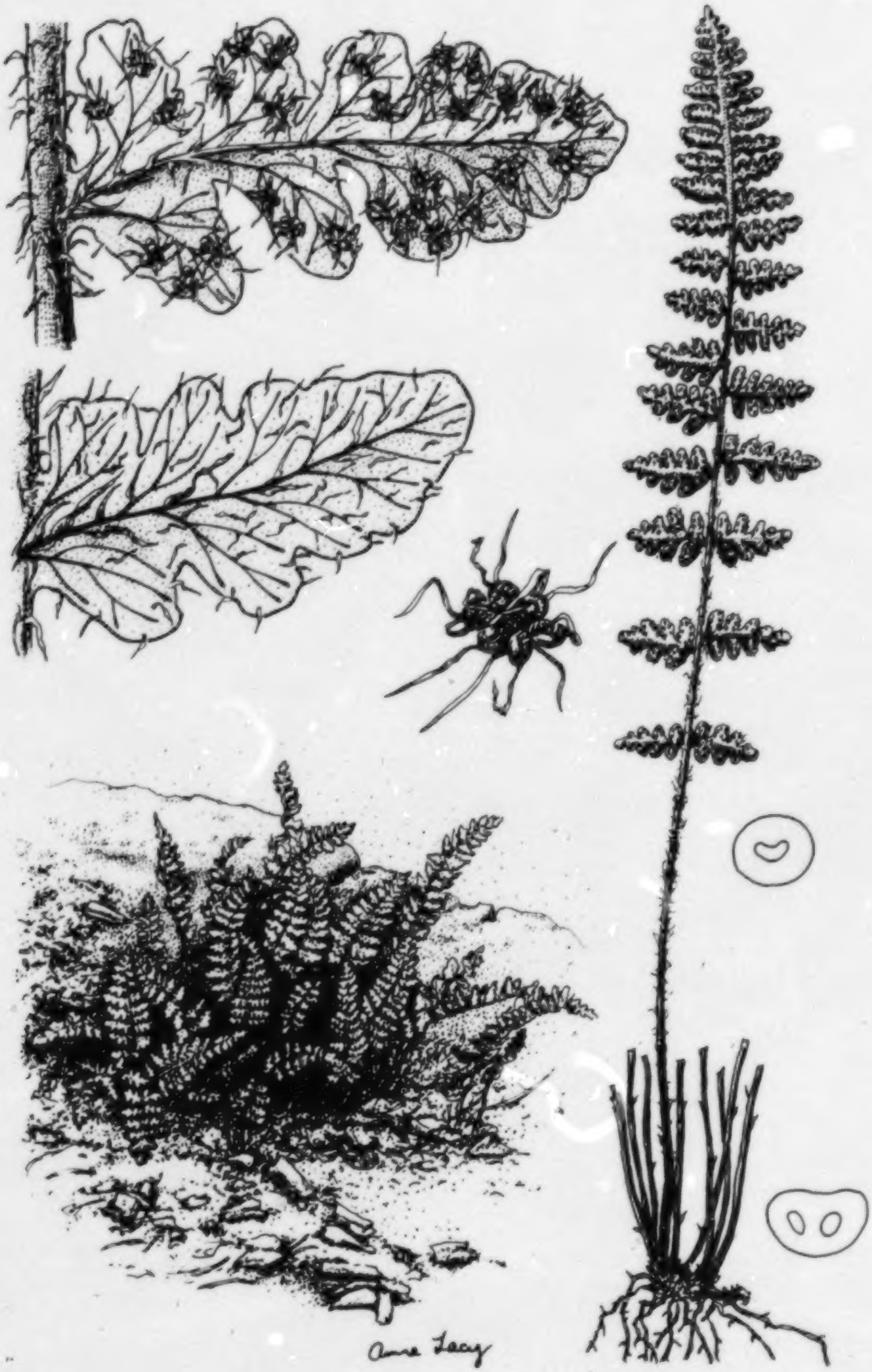
Woodsia alpina ALPINE WOODSIA

Plate 57

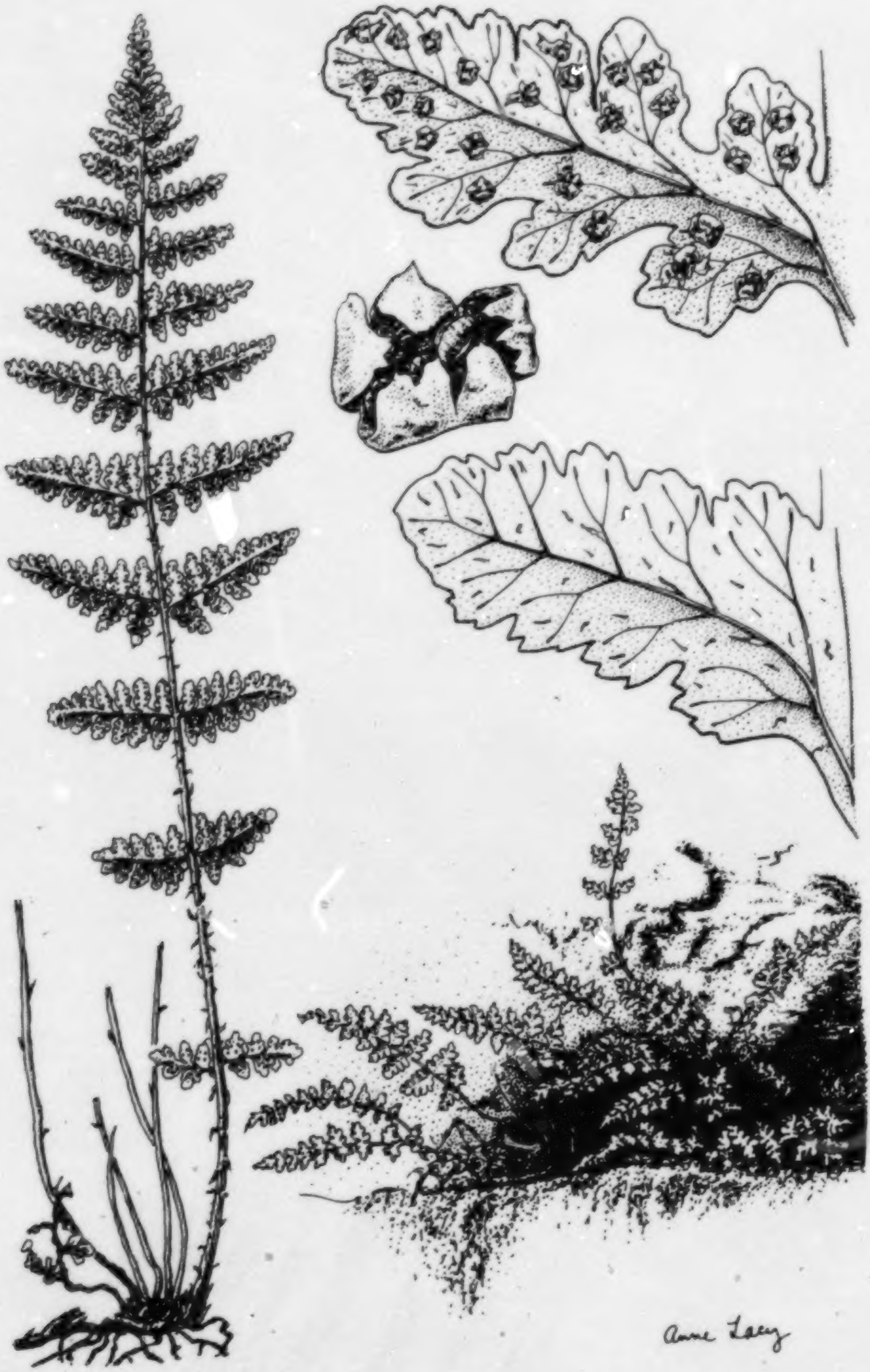


Woodsia glabella SMOOTH WOODSIA

Plate 58



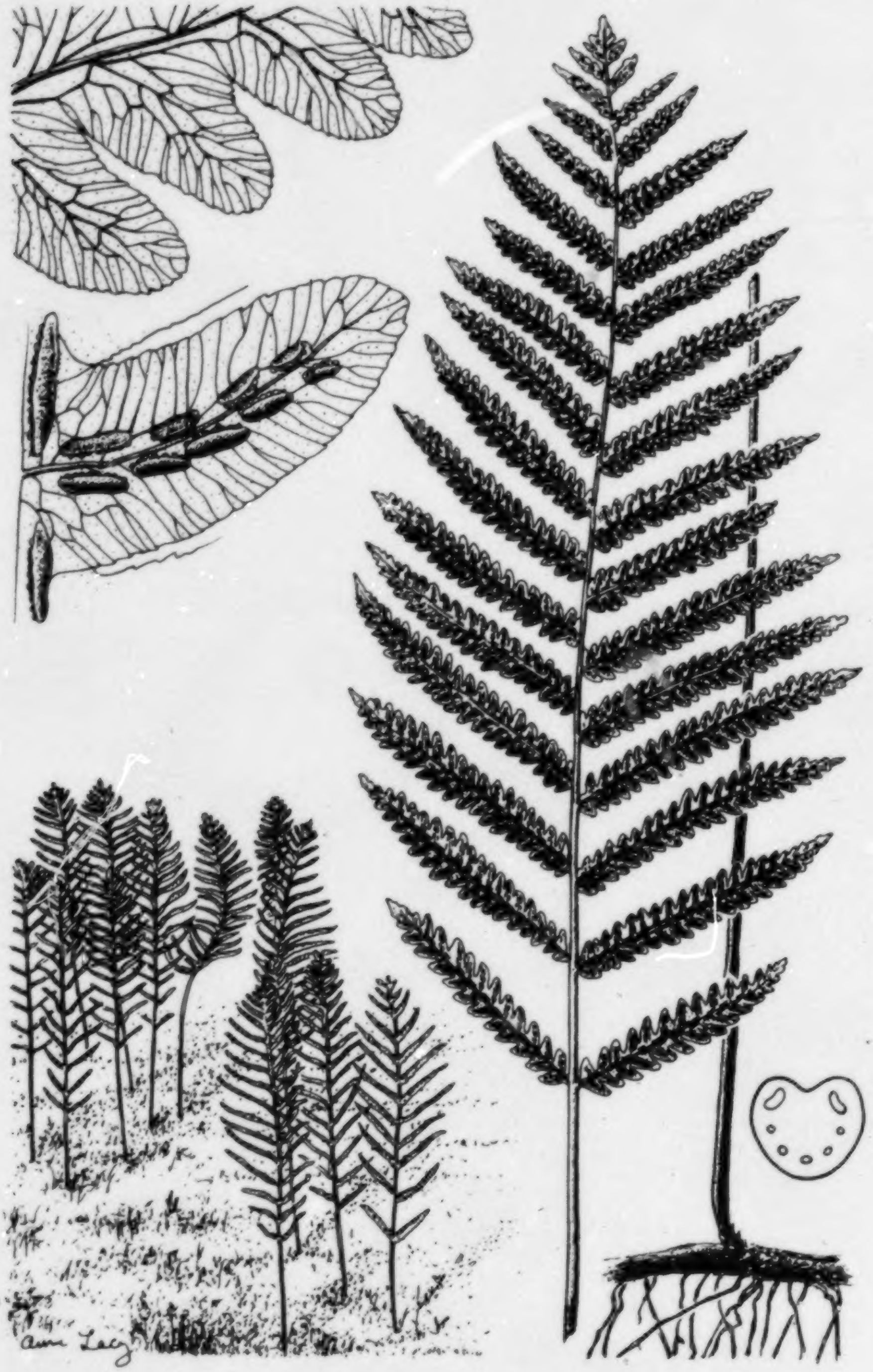
Woodsia ilvensis - RUSTY WOODSIA



Anne Lacy

Woodsia obtusa BLUNT-LOBED WOODSIA

Plate 60



Woodwardia virginica VIRGINIA CHAIN FERN both surfaces, with scales on the veins; margins crenate. VEINS free, forked, mostly not reaching the margin. SORI mostly not near the margin, circular, separate or confluent with age. INDUSIA cuplike when young, soon raylike, being small disks with 3-6 scalelike segments. SPORES bilateral.

Resembles *Cystopteris fragilis* which has no scales on the rachis.

A somewhat similar species, *Woodsia oregana* D. C. Eaton, is represented in our area only by variety *cathcartiana* (Robinson) Morton which is found in our area in but one locality in New York. Among our species of *Woodsia* it would appear most like *W. obtusa* from which it differs by having stipes without hairs and with scales only at base, pinnae with only 2-5 pairs of pinnules, and indusia with long hairlike rays.

Woodwardia virginica (Linnaeus) J. E. Smith

Plate 60

VIRGINIA CHAIN FERN

Anchistea virginica

NY, Vt (rare or extinct), NH, Me, Mass, Ct, RI, NJ, Pa.

Swamps, bogs, often in shallow water, does well in full sun. Soil slightly to very acid or, near the ocean, alkaline or brackish.

RHIZOMES woody, creeping, branching, 5-10(-20) mm in diameter, scaly at tips. CROZIERS without hairs or scales, reddish brown. FRONDS not dimorphic, borne singly from points on the rhizome, 45-140 cm long, not evergreen. STIPE about same length as blade 2-8 mm wide, greenish, reddish or purplish-brown, glabrous, with a few scales at base, with 2 large circular or curved bundles and 3-7 smaller ones. BLADES oblong-lanceolate, 30-80 cm long, 12-30 cm wide, deeply pinnate-pinnatifid to nearly bipinnate; rachis greenish-brown, with short hairs. PINNAE 15-20 pairs, alternate or nearly opposite, ascending, oblong, sessile, the largest mostly 8-15 cm long, 2-3 cm wide, lower pinnae shorter than middle pinnae, segments 15-20 pairs, nearly opposite, oblong, obtuse, 5-15 mm long, 5-6 mm wide, glabrous, usually with a few scales along the midveins; margins firm, nearly entire but with very tiny teeth. VEINS mostly free, forked and reaching the margin, but reticulate along the midvein. SORI not marginal, forming two rows along the midvein, oblong-linear, separate but contiguous, usually 10-12 on each segment and also others along the midvein of the pinna. INDUSIA laterally attached, opening toward the midvein, disappearing with age. SPORES bilateral.

GLOSSARY

The definitions in this glossary are for use with ferns. Some of the terms have a broader meaning or a slightly different meaning in some other publications.

acuminate: tapering to a long slender point.

acute: sharp-pointed; ending in a point less than a right-angle.

alluvial: soil deposited by water, usually rich in organic matter.

alternate: not opposite to each other but attached at different levels.

apex: tip or point.

attenuate: tapering gradually to a long tip.

auricle: an ear-shaped lobe or appendage.

basal: lowest.

bilateral: having two sides that are equal; two-sided; bilateral fern spores appear to be plano-convex.

bipinnate: twice pinnate.

blade: broad expanded portion of a frond.

bundle: group of specialized cells (conducting tubes and fibers) that, in cross section, appear much different from the surrounding tissue; do not confuse with cavities that may be present.

calcareous: soil containing lime; pH above 7.

cm (centimeter): equal to 1/100 of a meter or equal to 10 millimeters; an inch is approximately 2.5 cm long.

ciliate: fringed on the margin with slender hairs.

confluent: running into each other or blending together.

contiguous: adjoining; touching its neighbor.

coriaceous: leathery in texture.

crenate: having rounded teeth.

crenulate: with small rounded teeth.

crozier (or crosier): an uncoiling frond; young, coiled fern frond; fiddlehead.

cuneate: wedge-shaped.

cuplike: attached at the base and surrounding the sorus.

dentate: with teeth, usually directed outward.

denticulate: finely dentate.

dimorphic: of two forms; sterile and fertile blades, or parts of blades, appear much different.

dissected: cut into lobes or divisions.

elliptic: oval or lens-shaped.

entire: margin without teeth; may have large lobes.

evergreen: remains green during winter.

fertile: with spore-bearing structures.

fibrovascular: composed of fiber cells and conducting cells.

fiddlehead: crozier; curled young frond resembling the head of a violin.

free: distinct; separate; veins that are unbranched or forked but whose branches do not unite; not reticulate.

frond: leaf, including stipe and blade or blades.

genus: a closely related group (one or more species).

glabrous: without hairs.

hair: slender, linear outgrowth; it sometimes has a small, spherical, waxy tip.

hastate: arrow-head shape but with basal lobes pointing outward.

herbarium (herbaria): a collection of preserved plants, usually pressed flat, dried, mounted on stiff paper with appropriate labels, and filed for easy access; also the room or building where such plants are stored.

hoodlike: arching over the sorus in bladder-like fashion.

hybrid: result from a cross between unlike organisms.

indusium (indusia): a covering over or around a sorus.

lanceolate: lance-shaped, narrow, tapers to apex, widest below the middle.

linear: longer than wide, with parallel sides; at least twice as long as wide.

lobed: dissection less than half way to the midvein, usually rounded.

lunate: halfmoon or crescent-shaped.

membranous: thin and delicate; usually translucent.

midvein: middle vein of a blade, pinna, pinnule, or segment; midrib.

muricate: surface with small, sharp projections.

neutral: neither acid nor alkaline; with a pH of 7.

node: place on rachis where pinnae are borne; place on rhizome where fronds are borne.

oblong: short-linear, not more than three times as long as wide.

obovate: inverted ovate; egg-shaped, with broader end upward or outward.

opposite: a pair of parts attached at the same level across from each other, such as pinnae attached at the same level on the rachis.

ovate: egg-shaped in outline with the broader end downward or attached to the stalk.

palmate: with divisions radiating from a common center, like the fingers of a hand, may be lobes, pinnae, veins, etc.

peltate: umbrella-like, with a centrally attached stalk.

perispore: a loose covering around a spore which is distinct from the spore wall; sometimes called epispore.

pinna (pinnae): primary division of a dissected blade cut to the rachis; it may be undivided or divided one or more times.

pinnate: blade dissected all the way to the rachis, but the pinnae not further dissected half way to the midvein.

pinnatifid: blade or parts of blade dissected more than half way, but not all the way, to the rachis or to the midvein.

pinnule: secondary division of a blade cut to a secondary rachis or midvein.

plano-convex: plane (nearly flat) on one side and convex (rounded outward) on the other; spores of this shape are bilateral.

rachis: midvein of a dissected blade; continuation from the top of the stipe at the base of the blade through the blade to its apex.

random access: process for obtaining information in any order from a storage system; a random access key allows the user to choose any stored character in any order.

raylike: radiating from a center; a raylike indusium is similar to cuplike but splitting into broad or slender structures.

reflexed: turned or curled downward, outward, or backward.

reniform: kidney-shaped; similar to peltate but with a notch or sinus.

reticulate: like a network; anastomosing; veins that join again after dividing.

rhizome: underground stem.

scale: broad, flattened outgrowth; similar to hair but broader at base and usually of firmer texture.

segment: the smallest division (except lobe or tooth) of a dissected blade; the dissection extends more than halfway, but not all the way to the midvein.

serrate: sharp, sawlike teeth pointing toward the apex.

serrulate: finely serrate.

sessile: without a stalk at point of attachment.

simple: not branched.

sinus: cut or notch between two lobes.

sorus (sori): cluster of sporangia; area where spores are formed.

species: a group of closely related, mutually fertile individuals, sharing the same characteristics.

spinulose: with small spines or bristle-tipped teeth.

sporangium (sporangia): container in which spores are produced.

spore: tiny single-celled reproductive body (asexually produced).

sporocarp: organ containing spores or sporangia.

sterile: frond or blade lacking sori.

stipe: petiole or stalk of the frond, from rhizome to base of blade.

succulent: fleshy or juicy.

taxon (taxa): a taxonomic group; refers to an unspecified category, such as genus, species, variety, etc.

teeth: projections on the margins, usually with pointed apices, indented less than ¼ of the distance to the midvein.

ternate: divided into three nearly equal parts.

tetrahedral: having four sides; tetrahedral fern spores appear to be circular or nearly so.

tripinnate: blade three times dissected, forming pinnae, pinnules, and pinnulets.

triplanate: having three sides; triplanate fern spores appear to be triangular or circular.

vein: a strand of conducting tissue; it may be branched or unbranched.

venation: arrangement of veins in a blade.

winged: a border of thin, flat tissue as on the rachis of some ferns.

INDEX

A

- adder's-tongue 85
- *Adiantum capillus-veneris* 38
  - *pedatum* 38
- alpine woodsia 108
- *Anchistea virginica* 114
- *Asplenium bradleyi* 38
  - *cryptolepis* 42
  - *montanum* 38
  - *pinnatifidum* 38
  - *platyneuron* 38
  - *resiliens* 38
  - *rhizophyllus* 57
  - *ruta-muraria* 42
  - *trichomanes* 42
  - *viride* 42
- *Asplenosorus pinnatifidus* 38
- *Athyrium angustum* 42
  - *asplenioides* 42
  - *filix-femina* 42
  - *pycnocarpon* 47
  - *thelypterioides* 47
- *Azolla caroliniana* 47
  - *filiculoides* 47

B

- bead fern 85
- beech fern, broad 94
  - long 94
  - northern 94
  - southern 94
- blackstem spleenwort 38
- bladder fern, bulblet 62
- blunt-lobed woodsia 108
- bog fern 103
- *Botrychium angustisegmentum* 52
  - *dissectum* 47,57
  - *lanceolatum* 52
  - *lunaria* 52
  - *matricariae* 52
  - *matricariifolium* 52
  - *minganense* 52
  - *multifidum* 52,57
  - *neglectum* 52
  - *obliquum* 47
  - *oneidense* 57
  - *silaifolium* 52
  - *simplex* 57
  - *tenebrosum* 57
  - *ternatum* 52
  - *virginianum* 57
- boulder fern 67
- bracken 99
- brake fern 99
- Braun's holly fern 99
- brittle fern 62
- broad beech fern 94
- broad swamp fern 67
- bulblet bladder fern 62

C

- *Camptosorus pinnatifidus* 38
  - *rhizophyllus* 57
- chain fern, narrow-leaved 80
  - netted 80
  - Virginia 114
- *Cheilanthes lanosa* 62
  - *vestita* 62
- Christmas fern 99
- cinnamon fern 85
- cliff brake, purple 89
  - slender 62
  - smooth 89
- cliff fern, fragrant 72
  - rusty 108
- climbing fern 80
- Clinton's shield fern 67
- clover, water 80
- common polypody 94
- common wood fern 72
- crested shield fern 67
- *Cryptogramma stelleri* 62
- curly grass 103
- *Cystopteris bulbifera* 62
  - *fragilis* 62
  - *mackayi* 62
  - *protrusa* 62

D

- daisy-leaf grape fern 52
- *Dennstaedtia punctilobula* 67
- *Diplazium acrostichoides* 47
  - *pycnocarpon* 47
- *Dryopteris assimilis* 67
  - *austriaca* 67,72,76
  - *boottii* 72,76
  - *campyloptera* 67
  - *celsa* 72
  - *clintoniana* 67
  - *cristata* 67

- *dilatata* 67
- *disjuncta* 76
- *filix-mas* 76
- *fragrans* 72
- *goldiana* 72
- *hexagonoptera* 94
- *intermedia* 72
- *marginalis* 76
- *noveboracensis* 103
- *phegopteris* 94
- *simulata* 103
- *spinulosa* 67,72,76
- *thelypteris* 103

dwarf grape fern 57

E

ebony spleenwort 38
evergreen wood fern 76

F

fancy fern 72
Filix bulbifera 62
- *fragilis* 62

flowering fern 89
fragile fern 62
fragrant cliff fern 72
fragrant shield fern 72

G

giant wood fern 72
glade fern 47
Goldie's shield fern 72
grape fern, daisy-leaf 52
- dwarf 57
- lace-leaf 47
- lance-leaved 52
- leathery 52
- Oneida 57
- Virginia 57

grass, curly 103
green spleenwort 42
Gymnocarpium dryopteris 76
- *robertianum* 76

H

hairy lip fern 62
Hartford fern 80
hart's-tongue 94
hay-scented fern 67
holly fern, Braun's 99
- northern 99

I

interrupted fern 89

L

lace-leaf grape fern 47
lady fern 42
lance-leaved grape fern 52
leathery grape fern 52
lip fern, hairy 62
lobed spleenwort 38
log fern 72
long beech fern 94
Lorinseria areolata 80
Lygodium palmatum 80

M

maidenhair fern 38
- southern 38

maidenhair spleenwort 42
male fern 76
marginal shield fern 76
marsh fern 103
Marsilea quadrifolia 80
Massachusetts fern 103
Matteuccia pensylvanica 80
- *struthiopteris* 80

Mingan moonwort 52
Moonwort 52
- Mingan 52

mosquito fern 47
mountain spleenwort 38
mountain wood fern 67

N

narrow-leaved chain fern 80
narrow-leaved spleenwort 47
narrow swamp fern 67
netted chain fern 80
New York fern 103
northern beech fern 94
northern holly fern 99

O

oak fern 76
Oneida grape fern 57
Onoclea sensibilis 85
Ophioglossum pseudopodum 85
- *pycnostichum* 85
- *vulgatum* 85

Osmunda cinnamomea 85
- *claytoniana* 89
- *regalis* 89

ostrich fern 80

P

- *Pellaea atropurpurea* 89
  - *glabella* 89
- pepperwort 80
- *Phegopteris connectilis* 94
  - *dryopteris* 76
  - *hexagonoptera* 94
  - *polypodioides* 94
- *Phyllitis scolopendrium* 94
- *Polypodium virginianum* 94
  - *vulgare* 94
- polypody, common 94
  - rock 94
- *Polystichum acrostichoides* 99
  - *braunii* 99
  - *lonchites* 99
- *Pteretis nodulosa* 80
  - *pensylvanica* 80
- *Pteridium aquilinum* 99
  - *latiusculum* 99
- purple cliff brake 89

R

- rattlesnake fern 57
- rock polypody 94
- royal fern 89
- rusty cliff fern 108
- rusty woodsia 108

S

- *Schizaea pusilla* 103
- sensitive fern 85
- shield fern, Clinton's 67
  - crested 67
  - fragrant 72
  - Goldie's 72
  - marginal 76
  - spinulose 76
  - spreading 67
- silvery spleenwort 47
- slender cliff brake 62
- smooth cliff brake 89
- smooth woodsia 108
- southern beech fern 94
- southern maidenhair fern 38
- spinulose shield fern 76
- spleenwort, blackstem 38
  - ebony 38
  - green 42
  - lobed 38
  - maidenhair 42
  - mountain 38
  - narrow-leaved 47
  - silvery 47
  - wall rue 42
- spreading shield fern 67
- swamp fern, broad 67
  - narrow 67

T

- *Thelypteris cristata* 67
  - *dilatata* 67
  - *dryopteris* 76
  - *fragrans* 72
  - *hexagonoptera* 94
  - *noveboracensis* 103
  - *palustris* 103
  - *phegopteris* 94
  - *simulata* 103
  - *thelypterioides* 103
  - *thelypteris* 103

V

- Virginia chain fern 114
- Virginia grape fern 57

W

- walking fern 57
- wall rue 42
- water clover 80
- wood fern, common 72
  - evergreen 76
  - giant 72
  - mountain 67
- *Woodsia alpina* 108
  - *glabella* 108
  - *ilvensis* 108
  - *obtusa* 108
  - *oregana* 114
- woodsia, alpine 108
  - blunt-lobed 108
  - rusty 108
  - smooth 108
- *Woodwardia areolata* 80
  - *virginica* 114

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
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